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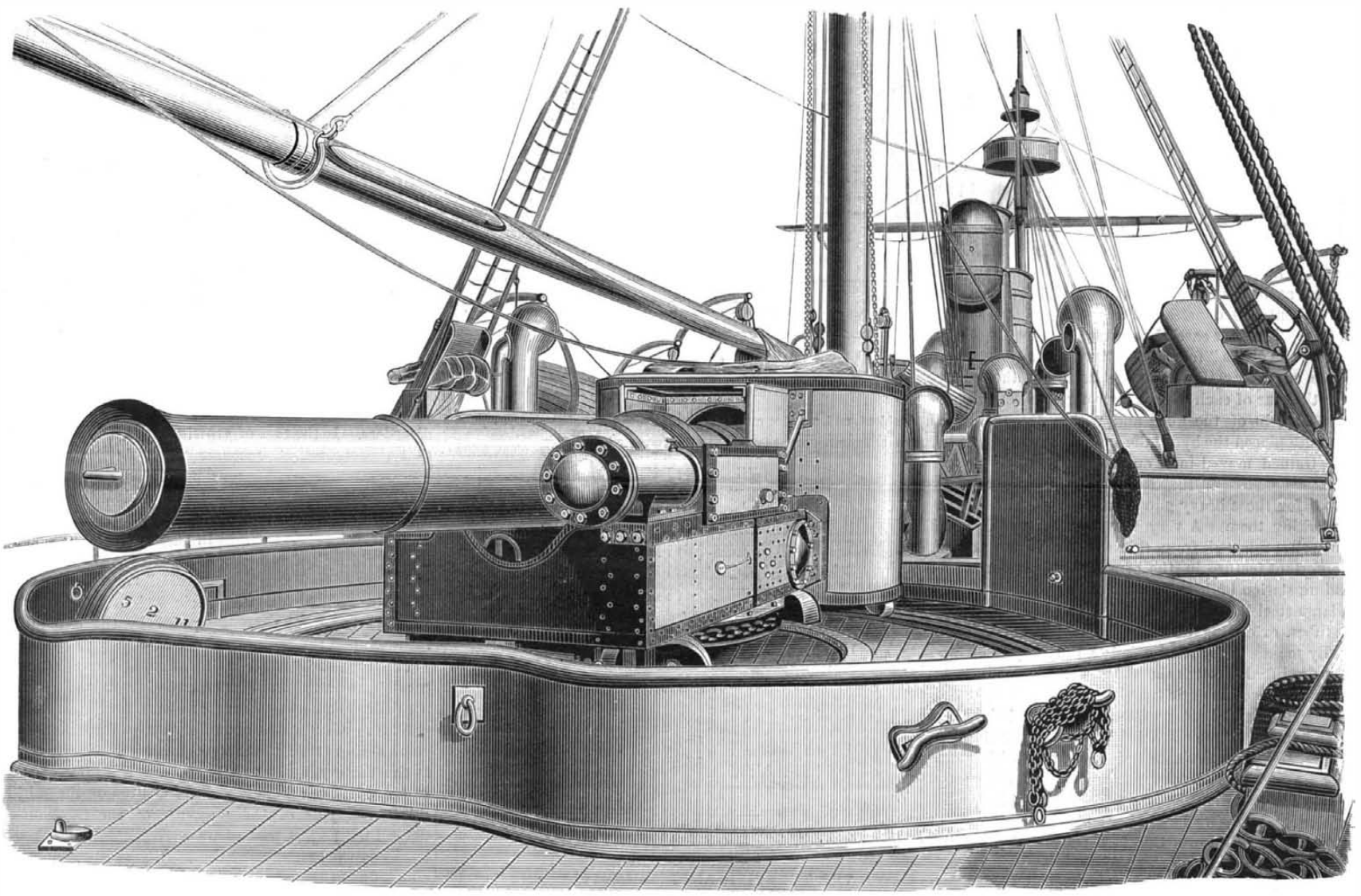
THE CHILIAN WAR SHIP ESMERALDA.

The Esmeralda was built by Messrs. Armstrong, Mitchell & Co., to the order of the Chilian Government, and only recently sailed from the Tyne for that country. Her construction was begun in 1882, and occupied rather more than two years. She might have been dispatched much sooner, but was prevented from leaving the Tyne owing to the war between Chili and Peru.

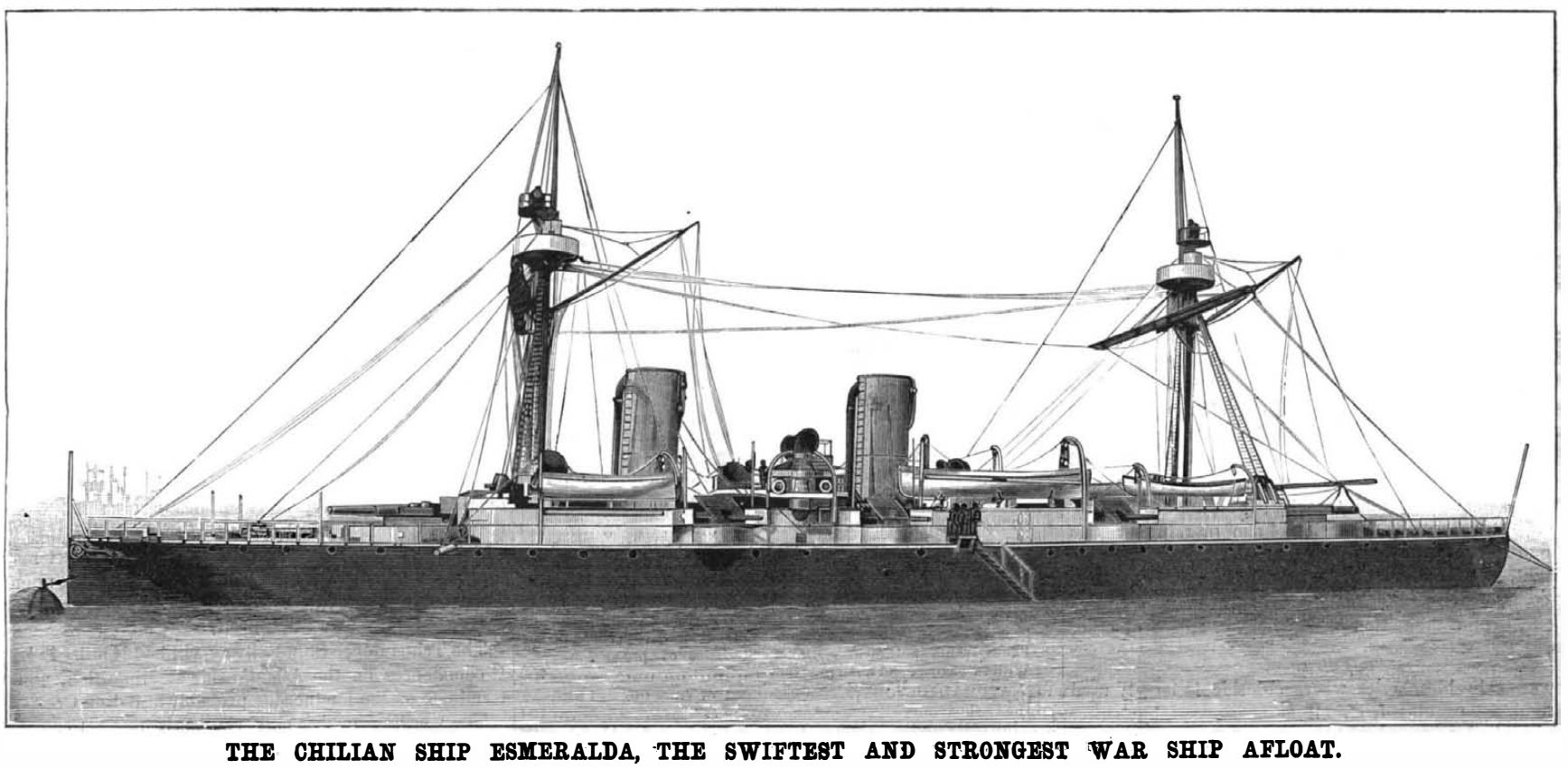
Her dimensions are: Length, 270 feet; breadth, 42 feet; displacement, 3,000 tons; draught, rather over 18 feet. When fully stored, armed, and equipped for sea she carries, in addition to several smaller guns, two 25 ton guns, each with a projectile weighing 450 pounds, with a penetrative power at the muzzle estimated at 21 inches of iron armor. The chief characteristic of the vessel is her speed. In her trial off the Tyne a few weeks ago she accomplished 18·28 knots per hour, being thus the fastest cruiser in existence.

Ironclads, says Sir William Armstrong, are almost useless for the protection of our merchant ships from depredation at sea, nor could mercantile and passenger steamers be adapted so as to act successfully as cruisers. What we want are powerful swift cruisers of the Esmeralda type, and a number of these can be constructed at the cost of a single ironclad.

The hull of the Esmeralda is steel built; she is framed on the ordinary transverse system, and is not wood-sheathed or coppered. There are three complete decks. The upper or gun deck is about 11 feet above water, and upon it all the heavy guns are carried in the open. The main deck is about 5 feet above water, and it is occupied throughout by most excellent quarters and cabins for officers and crew, for whom good natural ventilation and light are secured. The lower, or protective, deck is of 1 inch steel, and extends from



THE GUNS OF THE ESMERALDA.—TWENTY-FIVE TON STERN CHASER.



THE CHILIAN SHIP ESMERALDA, THE SWIFTEST AND STRONGEST WAR SHIP AFLOAT.

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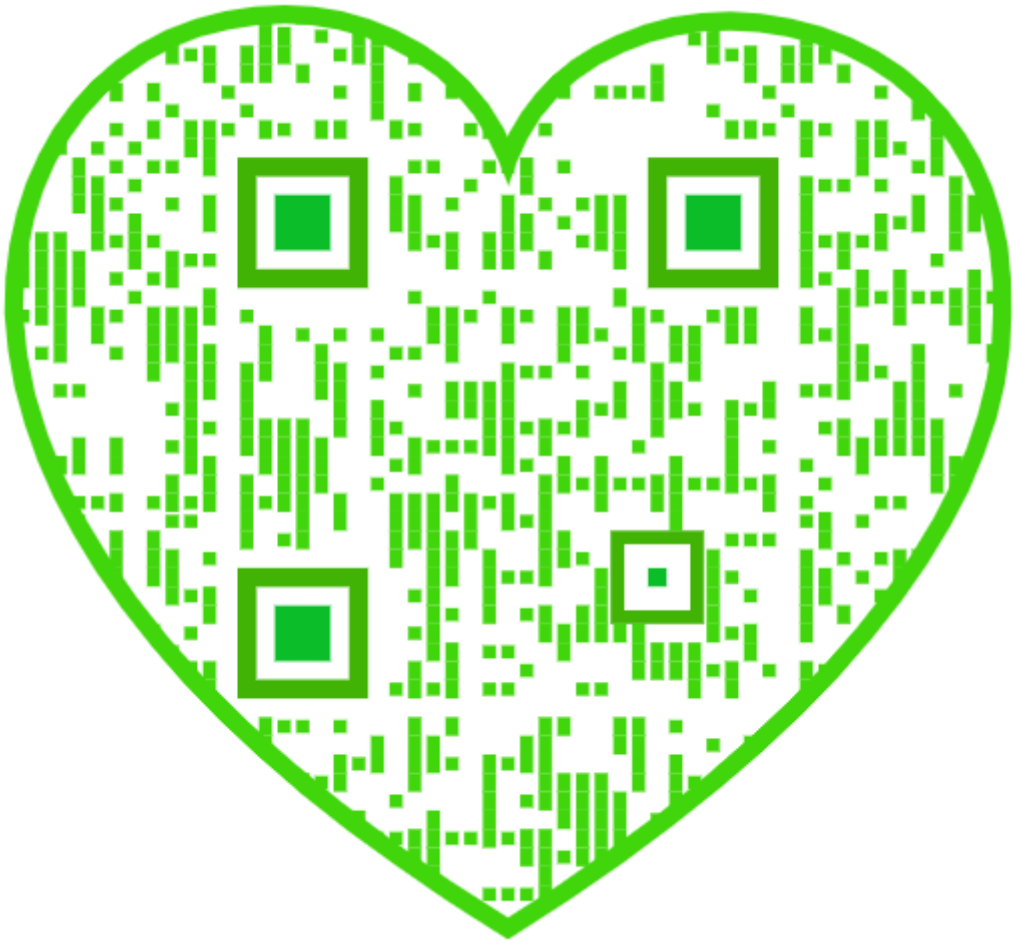

stem to stern; it is strongly arched in the athwartship direction, having a curve of about 4 feet. At the middle line this deck is about 1 foot below water, at the sides it is about 5 feet below. It forms a roof or shelter to the hold space situated below it, and in the space thus protected are placed the vitals of the ship—magazines, shell rooms, engines, boilers, etc.

Minute water tight subdivision of the hold space below the protective deck, and of the space between it and the main deck, is effected by means of transverse and longitudinal bulkheads and of horizontal flats or platforms. Magazines, shell-rooms, etc., are also converted into separate water-tight compartments. All openings in the protective deck are trunked up by water tight steel casings to the height of the main deck, and surrounded by cellular coffer-dams, which can be packed with canvas, oakum, or other material which would readily check the inflow of water if, in action, the trunk casings were shot through. This coffer-dam protection resembles that long used by the Admiralty constructors in vessels of the central citadel type; and another feature in the Esmeralda in which Admiralty practice has been imitated is in the use of cork, packed in cellular spaces, as a safeguard to her buoyancy, stability, and trim in case the sides in the water line region should be riddled in action. The steel deck is intended to be chiefly useful in protecting from shell fire the vital parts situated below it, and this protection is greatly increased by the conversion of the spaces between the main and lower decks into coal bunkers.

She has twin screw propellers driven by two independent sets of machinery. The engines are horizontal, and on the two-cylinder compound principle. The cylinders are 41 inches and 82 inches in diameter, and the stroke is 36 inches.

The armament is exceptionally heavy and powerful for a ship of such moderate size; and the mountings are of a very novel character, representing some of the latest products of the famous Elswick factory. It includes two 25 ton 10 inch breech-loading guns, six 4 ton 6 inch breech-loading guns; two rapid fire 6 pounders, of Captain Noble's design, and a number of machine guns. The 25 ton guns are mounted as bow and stern chasers, and have an arc of training of about 240 degrees—120 degrees on each side of the keel line. They are carried on central pivot mountings, and fire over a "glacis" formed by the ends of the upper deck. The engraving illustrates the nature of the mountings. On the rear of each slide is a strong steel screen, protecting the captain of the gun; and within the shelter of this screen are placed the hydraulic and other gear by which the gun is trained, moved in or out, elevated, and depressed. Hydraulic mechanism, of Elswick design and manufacture, is employed for these heavy guns, and used for loading as well as working them. A very few men thus suffice, and these are well protected from rifle and machine gun fire.

One important feature in the arrangement is the strong steel loading station built in the rear of each gun. This is really a large steel house, within which are the upper ends of steel tubes, extending down to the magazines and shell rooms. By means of hydraulic hoists the projectiles and cartridges are lifted through the tubes into the loading stations, being sheltered in their transit.

Having reached the loading station, the gun is laid fore and aft, and run in on the slide, being elevated for the purpose of loading. After the breech piece has been withdrawn, the projectile and powder charge are rammed home; and throughout the operations the powder is protected from rifles and machine guns. With large charges exceeding 2 cwt. of powder for the 10 inch guns, this is a matter of great importance. The penetrative power of these 10 inch guns is represented by 21 inches of iron armor; and both of them can be fought on either broadside, as well as being used for chasers.

On each broadside there are also three 6 inch 80 pounders, carried on central pivot automatic carriages, and having a horizontal range of training of about 130 degrees.

The Esmeralda has also a very good auxiliary armament with which to deal blows upon an enemy similar to those against which her men are exceptionally well protected.

We are indebted to the *Engineer* and the *Graphic* for these particulars and for our illustrations.

White Bricks.

M. Hignette, in the *Bulletin technologique des Ecoles nationales d'Arts et Metiers*, describes a new ceramic product from the waste sands of glass factories, which often accumulate in immense quantities so as to occasion great embarrassment. The sand is subjected to an immense hydraulic pressure, and then baked in furnaces at a high temperature, so as to produce blocks of various forms and dimensions, of a uniform white color, which are composed of almost pure silex. The crushing load is from 370 to 450 kilometers per square centimeter. The bricks, when plunged in chlorhydric and sulphuric acids, show no trace of alteration. The product has remarkable solidity and tenacity; it is not affected by the heaviest frosts or by the action of sun or rain; it resists very high temperatures, provided no flux is present; it is very light, its specific gravity being only 1·5; it is of a fine white color, which will make it sought for many architectural effects in combination with bricks or stones of other colors.

WORKERS in bleacheries where chlorine is largely used are singularly exempt from all germ diseases, but suffer from special ailments induced by inhaling that gas.

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GRINDING REAMERS.

Every machinist knows the tendency of reamers to chatter and leave flutings. The most careful handling could not always prevent it. For a remedy the scores or flutings of the reamers have been made of uneven numbers, so that a space should oppose a tooth; and sometimes a "slashed" or spiral tooth has been cut instead of a straight one. But no remedy has heretofore been found that is so effectual as careful using and a very light scraping chip.

In a large establishment for the manufacture of hand and machine tools, some experiments have been made with reamers with a result of nearly, if not entirely, removing this tendency to chatter. The remedy is in grinding the flutes or teeth on their face or cutting side, so that they present a sharper angle to the work, and cut rather than scrape.

After the reamer has been fluted in the milling machine or the crank planer, and hardened and tempered, it is submitted to the action of a narrow, round-faced emery or corundum wheel, that cuts under the straight face of the flute and projects its head forward, making a more cutting angle. Trials on very hard charcoal iron castings seem to prove the advantage of this after-grinding. This test was proved on a hole for a taper fit. The finished steel pin was placed in the reamed hole, and driven to seat by a Babbitt metal hammer. When driven back there was not a mark of the reamer's work, although the pin had been oiled to show the marks if any there were. Lampblacking the reamed hole and then driving or pushing in a plug of wood turned and covered with white paper gave a clear smut without any corrugations. In use the reamer cut so freely that no forcing was necessary.

WHAT THE DOCTORS SAY ABOUT BICYCLE RIDING.

Those who work the pedals of the graceful bicycle will, unhappily, find little to commend their favorite exercise in the columns of the medical journals. From time to time there have appeared the results of inquiries of the medical faculty into the effect produced upon the body by continued bicycling; and though a verdict may scarcely be said to have been rendered, the evidence presented proved, in some cases, sufficiently convincing to condemn the practice. The latest opinion on the subject is contained in a paper contributed to the London *Lancet* by Dr. S. A. Strahan, of Northampton. Neither Dr. Strahan nor those who preceded him on the subject condemn bicycling altogether; but when indulged in constantly and especially when the course traversed is rough or hilly, they agree that it leads to serious disorders. In the case of growing boys, Dr. Strahan declares that the amount of pressure upon the perineum directly affects the prostate, the muscles of the bulb, and indeed the whole generative system. "The pelvis," he says, "is flexed upon the thighs or rolled forward. This rolling forward of the pelvis is slight in easy riding, and very marked in fast riding and hill climbing. Now, when the body and pelvis are bent forward, the ischial tuberosities are raised from the saddle, and the whole weight of the body, save what is transmitted to the pedal by the extended leg, is thrown upon the perineum."

This results, he says, in irritation and congestion of the prostate and surrounding parts, tends to exhaust and atrophy the delicate muscles of the perineum, and leads to early impotence. Many cases could be cited where races have become almost totally impotent from immoderate equitation, as the Tartars, and partially so from the same cause, as the Indians. Like others who have written on the subject, Dr. Strahan speaks of the "disease of the Scythians," but doesn't tell us just what it was. We know that they were a warlike race and continually in the saddle, and can only conclude that he means this constant perineal pressure reduced them to the wretched condition in which Hippocrates tells us he found them. Hippocrates says: "Their bodies are gross and fleshy; the joints are loose and yielding; the belly flabby; they have but little hair, and all closely resemble one another." Yet bicycling is said to be ten times as severe on the perineum as riding.

THE EADS SHIP RAILWAY.

The working model of Captain James B. Eads' plan for the Atlantic and Pacific ship railway, now in process of construction across the Isthmus of Tehuantepec, has been brought from London, and is now on exhibition in this city, in the basement of the Mutual Life Insurance building, Nassau and Liberty Streets. As a specimen of fine mechanical work this model is quite remarkable, and probably surpasses anything of the kind heretofore constructed.

It represents the hydraulic lifting dock, by which the largest ships are quickly lifted out of water; the railway cradle and truck, by which the great vessels are transported across the country; and the hydraulic turn table, by which truck and ship are rapidly revolved to meet any required changes of direction in the line of travel of the railway.

The gigantic size of the cradle truck that bears the ship overland forbids the employment of curves of a less radius than twenty miles; but by means of the hydraulic turn table, which is simply a great float, the largest vessel may be turned, switched off to pass other vessels, and run upon any desired diverging track, thus obviating the necessity of curves in the railway track itself.

The Tehuantepec Ship Railway will be 134 miles in length. It commences on the Atlantic side at Minatitlan, and will terminate on the Pacific side probably at Salina Cruz.

The working model now shown is made to a scale of three-quarters of an inch to a foot, and occupies a length of

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about thirty feet. The model ship floats in water over a hydraulic pontoon, on which the railway cradle truck is placed. The working of the pumps soon raises the ship, and she rises out of water supported on self-equalizing hydraulic jacks, arranged in such manner that the lifted vessel, although above the water, may still be said to float thereon. Screw blocks attached to the truck cradle are now run up and secured against the ship's keel and bottom at many points. The hydraulic jacks are then released, which leaves the ship secured within the truck cradle, ready for the overland trip. Wherever a turn in the road is to be made, or vessels coming the other way are to be passed, the ship and truck are run upon a floating pontoon, the height of which is quickly adjusted, and the ship is revolved to the degree desired, to reach the diverging track, and the journey is then continued.

The various parts of this wonderful model are made to work with surprising ease and accuracy. Captain Eads' plans for the practical realization of this great ship railway, including the working model, were examined and indorsed by hundreds of the leading engineers in Europe, and there appears to be no doubt in their minds of its complete success. The estimated cost of the railway is only forty-five millions of dollars, and it will have a greater capacity for the transfer of ships than the proposed Panama Canal, on which, it is said about one hundred millions of dollars have already been spent, although the work may be said to have only just really begun.

Photo Enlargements on Canvas.

What is the best and cheapest method of producing an enlarged photograph from a small negative on canvas for the use of the colorist in oils? This is a query, says the *British Journal of Photography*, that comes to us with a certain degree of frequency. The question is one which admits of some latitude. It presupposes the existence of several methods, some of which are cheap; others—irrespective of cost—good. Having a small negative of a portrait, how are we to enlarge it in a cheap yet good style?

One of several methods which forces its attention upon us at the present time is that by the transfer of a collodion film from the glass plate, upon which it has been taken, to the canvas upon which it finds a final resting place.

Let us suppose that an artist is desirous of having a certain face and bust transferred to canvas. It is first of all necessary that the apparatus for producing a large image of the original be at hand. If daylight be the luminant employed, then the question is reduced to one of extreme simplicity. The negative is erected in such a manner as to have the sky as its background, and at a right angle to it is placed the lens by which an image is to be formed. A screen for receiving this image is erected at the other side of the lens, and the optical conditions are thus rendered complete.

We will now presume that the enlarged image has been obtained in a collodionized glass plate of any reasonable dimension—such as twenty or thirty inches in length by a proportionate breadth—and that it has been treated in such a manner as to insure permanence as well as the requisite amount of detail. What then? While the collodion image is being washed, let us turn our attention to the canvas upon which it is to be placed as a final support.

Canvas prepared for painters is readily procurable from those artists' colormen who make a specialty of this department of artistic requirements; and we now take it for granted that a sheet of such canvas has been obtained. The first thing to do with it is to sponge it all over with soda (monocarbonate) and water until every trace of greasiness has quite disappeared, allowing the water to flow freely over the surface. When this is the case a moderately strong solution of gelatine, containing a feeble admixture of chrome alum, is sponged over or otherwise applied to the surface of the canvas, and allowed to become quite dry. It is, indeed, better that such canvases should be kept in stock ready for use.

Let us now revert to the collodion image upon the glass plate. When it is found to be well developed and still clear in the shadows, the plate is laid, glass side down, upon a block or tablet which has been erected at one side of the sink at which the development and washing have been effected. The canvas, previously sponged over with water until plastic, is laid face down upon the collodion film, and pressed into close contact by means of the squeegee.

It is, of course, understood that the glass plate, previous to receiving its coating of collodion, shall have been thoroughly wiped over with a rubber charged with finely powdered French chalk or with a solution of beeswax in turpentine or other solvent. We find in our own practice that French chalk answers the purpose admirably, and, as it is cleanly and easily applied, we commend its use to all who try this process.

The plastic canvas, now quite wet, must be pressed into intimate contact with the equally wet collodion film containing the image, and the plate is then laid down upon a flat table, a few folds of blotting paper, backed by a thick pad, being superposed. This must remain undisturbed for a short time, after which a trial may be made at one corner to see if the canvas when raised carries with it the collodion film, which becomes detached from the glass in favor of the textile fabric. If the film be found to attach itself to the canvas, the latter should be carefully raised from the glass.

The great advantage of effecting the transfer previous to the canvas and film becoming dry is that the film adheres in a most perfect manner to the canvas—certainly adapts itself more perfectly to the textile character of the fabric—and dries *flat;* whereas, if the transfer be not made until the film has become quite dry, the surface is of a shining and glossy character, being, indeed, then a transcript in regard to mechanical smoothness of the surface of the glass, which from an artistic point of view is somewhat offensive.

When the canvas is stretched out so as to become quite dry, the collodion film will, upon being dried, be found to have become "part and parcel" of its surface. There will be no gloss, but the interstices of the textile fabric will be as plainly shown through the thin collodion image-bearing film as if no such pellicle were superposed upon its surface.

Swift War Ships.

An opinion was at one time prevalent to the effect that a high rate of speed could only be attained by vessels of very large dimensions, until Sir E. J. Reed demonstrated the fallacy of this assumption by designing the Pallas. The Iris and Mercury, designed by Mr. N. Barnaby, and the Sfax, of the French Navy, designed by M. Bertin, which are the swiftest cruisers of the respective navies, are vessels of considerable size; but Herr Dietrich, chief constructor of the German Navy, has shown that a high rate of speed can be got out of a cruiser of, comparatively speaking, insignificant dimensions. We refer to the Blitz, launched in 1882, which is a vessel of only 1,380 tons. She carries an armament of one 4¾ inch and four 3⅜ inch Krupp guns, as well as torpedo discharging apparatus, and is propelled at a speed of 16·2 knots by engines of 2,816 indicated horse power. The successful performances of this craft have, no doubt, induced our own and the French naval authorities to follow suit, the former with the Alacrity and Surprise, and the latter with the vessels of the Condor type.

We have already observed that speed is, in our opinion, the most important requisite of a modern cruiser, even if it is purchased to some extent at the cost of her fighting power. Messrs. Sir W. G. Armstrong, Mitchell & Co. have, however, proved that an enormously powerful armament can be combined with a high rate of speed in vessels of moderate or even small dimensions. The Protector, for instance, is a vessel of only 900 tons; yet she steams 14·2 knots, and carries one 8 inch and five 6 inch breech loading guns. The Japanese cruiser Tsukushi is another vessel of the Elswick type. She has a displacement of 1,500 tons, steams 17 knots, and mounts two 10 inch and two 4¾ inch breech loading guns. The largest vessels of this class at present afloat are the Italian Giovanni Bausan and the Chilian Esmeralda, sister ships. The Esmeralda has a displacement of 3,000 tons, a mean speed of 18·3 knots per hour, and carries two 10 inch and six 6 inch breech loading guns. It is not probable that her designer, Mr. W. H. White, will rest satisfied with these results, and we may therefore expect to hear of even still greater achievements ere long. Unfortunately, the British Navy has not as yet derived any benefit from the experience and enterprise of the Elswick firm; and while Italy, Austria, Japan, China, Chili, and other possible enemies are availing themselves of our national resources, we are "fascinated" by the activity prevailing around us, and are seemingly incapable of energetic exertions. The smaller foreign naval powers, notably Germany, are watching the gradual decline of our naval supremacy with evident satisfaction, as their second rate fleets are thus brought into greater prominence. The German Navy is composed of seventy-four steamships, including twenty-seven iron clads, which force is sufficient to secure an overwhelming majority to the navy of either France or England, should the interests of the empire necessitate its active participation on one side or the other in the event of war between England and France.—*The Engineer.*

Armor Experiments at Spezia.

The following statement of the results obtained during the recent armor plate trials at Spezia is from an Italian source, and has not been verified by us. We have no reason, however, to question its substantial accuracy in all respects. It will be seen that the gun has again scored a victory, and in so far the armor controversy assumes another phase. In a letter to the *Times* marked by all his great ability, Sir E. J. Reed criticises unarmored cruisers, and endeavors to show that their destruction must be certain should they encounter an ironclad. The Spezia experiments, however, seem to indicate that the only armor which can be of any real use must be so thick and of such enormous weight that the construction of a small high-speed armored cruiser is out of the question. In other words, the fact seems to be that against such guns as those carried, let us say, by the Esmeralda, vessels of the Penelope or Bellerophon type, carrying moderately thick armor, would be as badly off as the Esmeralda herself, while the greater speed of the latter ship would place her in a position to fight or not just as she pleased, and to fight when and how she liked.

The experiments against armor, which took place on the 1st October at the polygon of Muggiano by the Royal Italian Marine, have excited a lively interest in the marine and in military circles. These experiments had been ordered by the Minister of Marine to find out exactly the resistance of the armored redoubts of the Italia and Lepanto, clad with Schneider steel or compound plates, and above all to ascertain the effective power of the new Armstrong 43 centimeter breech-loading gun, with forged and tempered steel projectiles of best quality. For this purpose there had been erected three targets representing the redoubt of the Italia. The plates were placed against a backing of teak wood 520 millimeters thick. The plates measured all three 3,050 millimeters long by 2,600 millimeters wide, by 480 millimeters thick, and were all fixed to the backing by eighteen bolts. One of the plates was forged Schneider steel from the works at Creusot, and two of the compound type from Cammell's and Brown's works. In all experiments hitherto made, chilled cast iron or steel cast projectiles had been used with a velocity not exceeding 470 meters at impact. In the experiment of the 1st October, not only were forged steel Krupp projectiles used—which are supposed to be the best at present—but they were also fired with a velocity of 580 meters, *i. e.*, with 100 meters more velocity at the point of impact than in the previous tests.

The introduction of these two new factors in the firing were, as had been perfectly foreseen, of such a nature as to modify the results obtained. In effect, the Schneider and the compound plates had until now broken the projectiles of medium quality, such as cast iron and cast steel, at the first shock. Such shot produced in the plates damage varying according to their degree of fragility, without piercing them.

The new forged steel projectiles, such as those of Krupp's make, possessing tenacity and great cohesion, require, in order to break them, an effort and space of time infinitely greater than those of cast iron or brittle metal, so that their effort of penetration or punching the material of the plates has time to develop itself before the pieces of the projectile become separated.

In the test of the 1st of October, the circumstances foreseen by the competent authorities were completely verified. The 43 centimeter Armstrong gun was charged with four bags of 87½ kilogrammes each, being altogether 350 kilogrammes of progressive Fossano powder, and a perforating hollow projectile of forged and tempered steel from Krupp's works at Essen, weighing 835 kilogrammes weighted. Under these conditions the initial velocity measured at each discharge was an average of 572 meters, and the target being at a distance of 99 meters from the mouth of the gun, an average velocity at impact of 568 meters was the result. The projectile had therefore a total energy of 13,700 meter tons at impact, that is to say, the energy required for piercing an iron plate 99 centimeters thick, according to the formulæ of the French Navy.

Under such conditions of firing, which have never hitherto been produced with any gun, the following results were obtained: The first shot fired against the Cammell plate pierced it and the backing, dividing the plate into six large pieces by radial cracks. The shot was broken up, the point being carried to the sandhill, distant 15 meters, which it entered to a depth of 400 millimeters. The second shot was fired against the Brown plate. The results were similar. The plate was divided into four pieces only by radial cracks, but the steel face was torn off round the point of impact. The projectile was more broken up than in the first shot, and the point was found lying at a distance of 7 meters in the rear of target, *i. e.*, in the front of the sandhill. The third shot was fired against the Schneider plate. The projectile pierced the plate neatly, like a punch, forming a circular hole 580 millimeters diameter. The plate was divided into three large pieces by radial cracks. The projectile was found to be least broken up of the three, and the point to have entered the sandhill to a depth of 1,400 millimeters.

The compound plates have therefore, it appears, shown more resistance to penetration than the steel plate, although they were more broken, as anticipated, but no portions were stripped from the target, and the lateral support which the compound plates have from the adjoining plates when fixed on the ship's sides would place them there under much more favorable conditions than in the Spezia experiments; while the same conditions would not increase the resistance of a softer material, such as the Creusot steel plate or an iron plate. As compound plates 48 centimeters thick under favorable circumstances have shown such resistance to penetration at close range and normal fire of the present most powerful gun, it is evident that, when placed on a ship—especially at an angle, as in the Lepanto and Italia—they will afford perfect security against the attack of the same gun when fired at any probable distance and under the most favorable circumstance which are likely to exist in actual warfare. They have also the well known advantage of resisting the projectiles from small guns better than steel plates. These can be destroyed by projectiles which would have very little effect on compound armor.—*The Engineer.*

Treating Tellurium with Nitric Acid.

It is generally admitted that in the reaction of tellurium and nitric acid the only product is tellurous anhydride. M. Klein in a former communication described a basic telluric nitrate obtained on attacking tellurium with a large excess of hot dilute nitric acid. The authors having re-examined the matter, find that on treating tellurium with nitric acid there is formed—(1) a solution of tellurous hydrate soluble in nitric acid (at about 0°); (2) a tellurous nitrate, which is decomposed at 70° to 80°, forming tellurous anhydride and a basic nitrate. This tellurous nitrate is formed at about 20°, and is decomposed spontaneously on standing, even in the cold, into basic nitrate and anhydride. The basic telluric nitrate is also decomposed by water. The properties of tellurous anhydride have been very incorrectly described. It is spoken of in the text-books as slightly soluble in water. But it is almost as insoluble as barium sulphate, 1 part requiring for solution 150,000 parts of water.—*D. Klein and J. Morel.*

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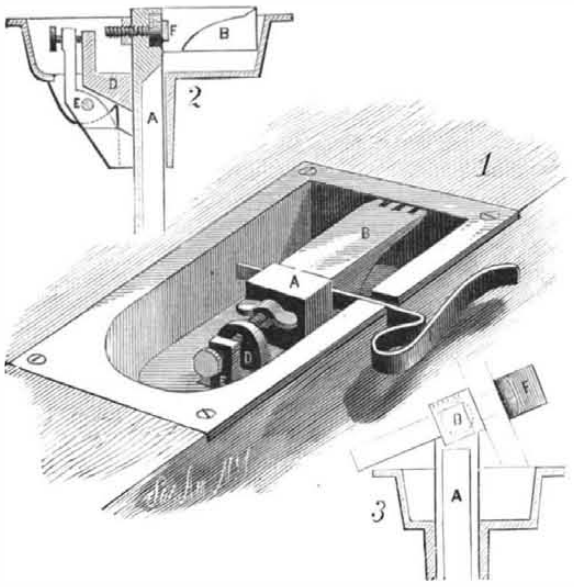
IMPROVED BENCH STOP.

In the annexed engraving, Fig. 1 is a perspective view, Fig. 2 a sectional side view, and Fig. 3 a cross sectional view of a bench stop lately patented by Mr. John Adams, of Walton, N. Y. The case is formed with top flanges, so that it may be let into and fastened flush with the top of the bench; and on the under side is a tube to receive and guide the post. The post, A, passes through the tube, and carries at its upper end the stop proper, B, which is of suitable form and attached to the post by a screw as shown in Fig. 2. The stop is made with a cross slot that receives the



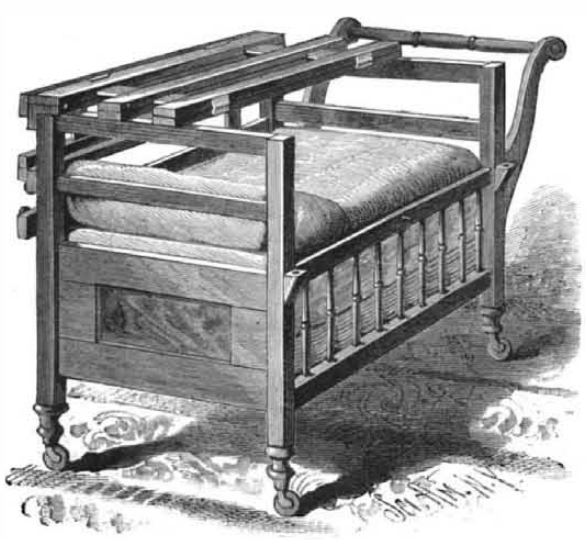
ADAMS' IMPROVED BENCH STOP.

shank of a spring clamp, F, the end of which projects through a slot in the side of the case, so that the spring is held at the side of the bench for clamping the work. The spring may be set in or out for holding thin or thick material, and it is clamped to the post by a screw and nut. When not needed it may be put in from the opposite side, as in Fig. 3, or entirely removed. Upon the under side of the case are lugs to which is hung a clamp, E, whose lower end bears on the post, and upper end extends up through the bottom of the case. In the upper end is clamped a thumbscrew arranged so as to take a flange on the case and force the lever against the post, thereby holding the latter firmly at any elevation.

With this stop, work can be held upright or flat on the bench, or at any desired angle, so that the plane can be held level. The spring clamp can be used in place of a vise for holding boards. The parts are easily adjusted, both thumbscrews being convenient to use, and it is adapted for all wood working done on benches.

FOLDING TOP CRIB.

The accompanying engraving shows a child's crib recently patented by Mrs. Charlotte P. Allender, of Cuba, New York. To the corner posts of the crib, which are made with upward extensions connected at the ends by cross-bars, are attached the sides and ends in the ordinary way. To the rear posts and the rear halves of the top cross-bars are secured longitudinal bars. The forward parts of the top cross-bars and the front posts are provided with rack sections, which are hinged to each other and to the inner longitudinal bar, so that two or more sections can be turned back to give ac-



ALLENDER'S FOLDING TOP CRIB.

cess to the crib. To the lower corners of the one section are attached dowel pins that enter holes in blocks on the posts, to prevent the section from swinging outward. This section is fastened down by a hook or other suitable means. The crib is placed upon casters, and at one end is a handle. With this construction the crib—which the inventor terms the Excelsior Folding Top Crib—can be readily moved from place to place, and the child is prevented from climbing or falling out.

AXLE LUBRICATOR.

The barrel, or cylinder, A, serves as a reservoir for the oil to be fed to the bearing—for instance, the arm of an axle on which a vehicle runs, as indicated in the engraving. In the interior of the barrel is centrally held, by end bearings, a screw on which is placed the plunger, B, fitted liquid tight, so that none of the oil can escape behind it. One end bearing of the screw consists of a pin entering a recess in the end wall of the chamber, and the other end is journaled in a removable end cap. By turning the hand wheel, C, the piston may be moved toward the axle arm to force the oil through a channel to the axle. The cap permits the insertion of the piston and access to the latter for repair or removal at any time required. The barrel is filled with oil through an opening in the top closed by a suitable cap. The lubricator is secured to the axle by a clip, which may at the same time serve to fasten the tongue, hounds, or any other part of the running gear.

The lubricator being attached to the axle, the piston is moved back as far as it will go, when the oil is poured in. By reversing the motion of the screw, at any time required, some of the lubricant can be forced to the exterior of the axle arm. The channel enters near the top of the chamber, in order that no oil will flow therefrom except as it is forced out by the piston.

This invention has been patented by Mr. Henry Keller, of Corpus Christi, Texas.

Oiling the Waves.

Oiling the waves has recently been the subject of investigation and exhaustive report by Captain H. W. Chetwynd, R. N., Chief Inspector of Lifeboats, at the instance of the Royal National Lifeboat Institution of Great Britain. The *Telegraph*, London, reports the result as follows:

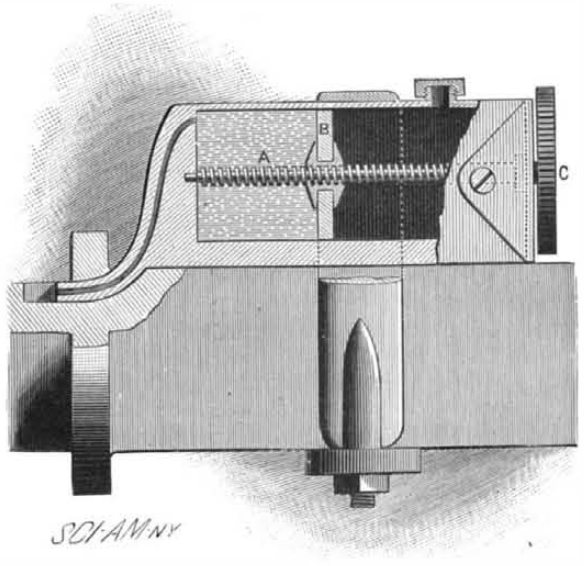
"Various conditions of the sea and all manner of oils were tested, and in reference to the latter Captain Chetwynd says they are all very much alike in their effect. Only very small quantities of oil indeed were necessary for covering a considerable distance with a smooth, glassy surface. The effects of this oily film in rollers that would endanger the safety of small open boats was most marked. It entirely stopped their breaking, leaving only the undulations or roll of a harmless swell, and thereby robbed them of their danger; but in surf of sufficient magnitude to be of importance to a lifeboat, or such as are ordinarily encountered by them, this effect was very much modified, and frequently entirely absent. On more than one occasion, in a moderate surf, which the oil was entirely 'killing,' if a larger breaker than the surrounding one rose the oil was powerless to check it, and the sea broke through it, covering boat, gear, etc., with oil. Its want of power to overcome the dangerous part of a heavy surf in shoal water (viz., the break) was clearly shown on more than one occasion, even when the oily film could be distinctly seen on the surface between the breakers. It seemed to fail in a very marked and curious way to have any effect on breakers caused by a heavy ground swell, and not by wind, on the coast of Cornwall. To be any protection, says Captain Chetwynd, it must be applied to the sea from the boat or vessel in the direct line from which the seas are advancing, and at sufficient distance to give it time to spread and act upon the waves before they reach the vessel to be protected. This could only be done in a lifeboat in two positions, viz., first, when anchored and lying head to sea and tide; and, secondly, when running dead before the sea for the shore. In any other position, even supposing the oil to be calming the sea, it would most probably be impossible to keep the boat within its influence, and proceed toward a wreck, or other desired point, at the same time. This difficulty would be considerably enhanced by the fact of the tide or current, on the greater part of the coast, setting with more or less velocity along shore. Under these circumstances, Captain Chetwynd is of opinion that no practical advantage can arise from the use of oil in the boats of the Institution, and he cannot, therefore, recommend its being supplied to them.

"With respect to its use as a protection to ordinary open boats in (to them) dangerous surf or breakers, the experiments appear to demonstrate clearly that, although it cannot be considered a 'specific' certain to insure immunity from danger in all cases, yet in many cases it would prove a very material protection, and go far to insure the boat passing safely through what would otherwise prove very dangerous, and possibly fatal, seas, and on that account alone its adoption cannot be too strongly urged for boats having or likely to have to encounter these dangers. As to the effect of oil in the open sea, Captain Chetwynd could not make personal experiments, but from well authenticated cases he believes that it is considerably more beneficial than off shore, and he strongly recommends vessels to carry oil, with perforated canvas bags for its distribution. The application of oil at harbor entrances is also advantageous to a certain extent, but there remain many practical difficulties in the way."

"I CAN always tell the nationality of an engineer by the complaint he makes," said an old engine builder and repairer in one of our contemporaries. "The Scotchman is always worried about the 'bock losh;' Englishmen and Irishmen are always fighting 'the thump,' which they firmly believe was left there for them to remove; the German is very much concerned about 'dem walves;' while the Yankee has a hard time to 'keep her from chawin' too much steam.'"

IMPROVED ROAD VEHICLE.

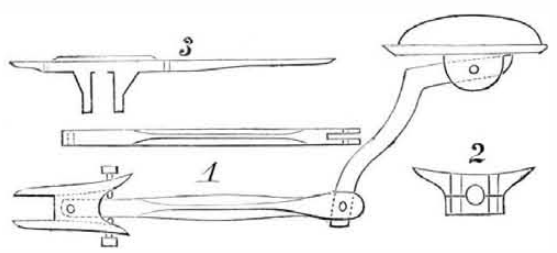
The shafts may be located directly on the axle, or they may be placed above and connected to it firmly by bent bars. For connecting the seat body to the axle independently of the shafts, a bolster is attached to the axle by means of boxes on which to place the springs, for the main support of the body directly under the seat which is balanced thereon. For the support of the body at its front end a clip is attached to the middle of the axle by a clamp which extends forward a suitable distance to connect with the rear slotted end of an arm, the connection being made by a pivot



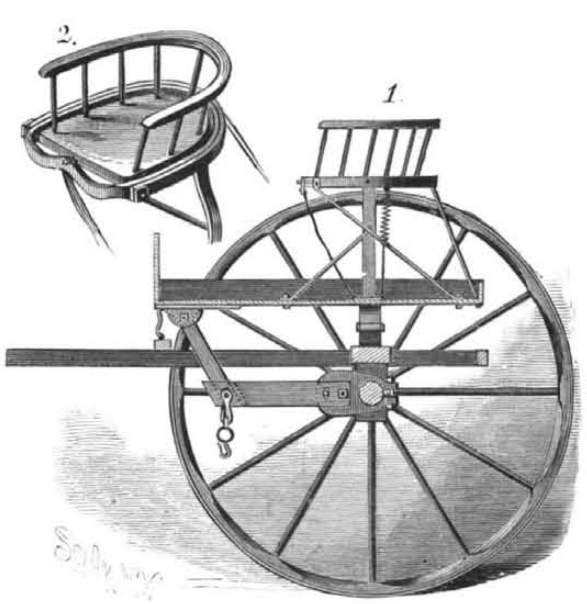
KELLER'S AXLE LUBRICATOR.

bolt and a second bolt that has a little vertical play in the clip plate. The arm extends forward not quite to the end of the body, and carries a support pivoted in a slot in its end; this support extends upward to the bottom of the body, and is pivoted between the ears of a socket. The upper end of the support is considerably widened to make points that serve for stops to limit the vibration of the body, caused by the play of the arm and also by the forward or backward movement of the body on the axle.

The center pivot bolt supports the clips to which the



whiffletree is connected. By this simple arrangement the body will not be subjected to any vibration by the shafts, and it will be greatly relieved of any vibrations of the axle. In order that the seat may be still further relieved, the frame of the seat is pivoted near its center to an outer frame connecting with supports; the frame has side springs just back of the pivots, which permit some vibration to counteract the effect of any vibration of the body. In front is a strap to adjust the seat to the convenience of the user. To avoid



AXFORD'S IMPROVED ROAD VEHICLE.

any side motion, and always insure a horizontal position for the seat, it is pivoted to the frame at the center of its front and rear edges; the frame is depressed in front for the thighs. Figs. 1, 2, and 3 (upper engraving) show the parts adjusted for a square axle; Fig. 1 being a plan and side view of the arm and attachment, Fig. 2 being the journal, and Fig. 3 the shaft clip.

This invention has been patented by Mr. Frederick J. H. Axford, of Cornwallis, Nova Scotia.

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IMPROVED WATER SOFTENING APPARATUS.

Mr. P. A. Maignen exhibits at the London Health Exhibition a new process of softening water, which is equally applicable on a small scale for domestic purposes as for dealing with the largest quantities. The desirability of reducing the hardness of water is too well appreciated to require much comment. Permanent hardness is due to the presence of sulphates of lime and magnesia, which cannot be disposed of in so simple a manner as the bicarbonates, but remain in the water after exposure to boiling or treatment by Dr. Clark's process, and give it a permanent hardness which, in the case of London water, reaches as much as 4 deg., and sometimes even 7 deg. Clark's process—which, as far as it goes, is exceedingly efficient, and which in one form or another is practically the only system in general use at the present time—is not applicable for ordinary houses, on account not only of the first cost and bulk of the installation, but of the care and attention required in working it; and although Mr. Porter's modification of it has been successfully applied for softening water for large mansions, it cannot be denied that the apparatus is bulky and somewhat complicated.

Mr. Maignen's process, says *Engineer*, deals with permanent as well as temporary hardness, and consists in mixing with the water to be softened a fine powder called anti-calcaire, which acts upon the salts in solution, and precipitates them. The anti-calcaire is composed of three reagents, prepared in a highly triturated state, the composition varying according to the nature of the water. These reagents have different degrees of solubility, and act in three distinct periods of time, first upon the carbonate of lime, and then upon the sulphates of lime and magnesia. When a small quantity of water has to be softened—such, for instance, as is required for use in a dressing room—it is sufficient to put in the ordinary water jug at night as much anti-calcaire as will cover a shilling, filling up the jug after the introduction of the powder. In the morning the water will be found perfectly soft and clear, the objectionable sulphates and carbonates having been precipitated to the bottom in the form of a fine powder, which is of course removed before filling the jug again. We have ourselves tried the process in this way with the Kent water, and found it exceedingly efficient.

The same system may be applied on a large scale in the scullery or kitchen by using a tub, the water being drawn off by means of a tap; and if time cannot be allowed for complete subsidence by gravitation, the remaining precipitate may be removed by filtration through a "Filtre Rapide." When storage capacity in tanks can be obtained for a couple of days' supply, water can be softened even on a large scale without further outlay for plant, as on account of the rapid subsidence of the precipitates it is sufficient to mix with each day's supply the proper proportion of the powder, and allow it to stand for not more than twelve hours before drawing off. One tank would then be in use while the other was being cleaned.

Another method of applying the process is shown in Figs. 1 and 2. This consists of two cisterns, in one of which the softening is performed, and in the other the filtration.

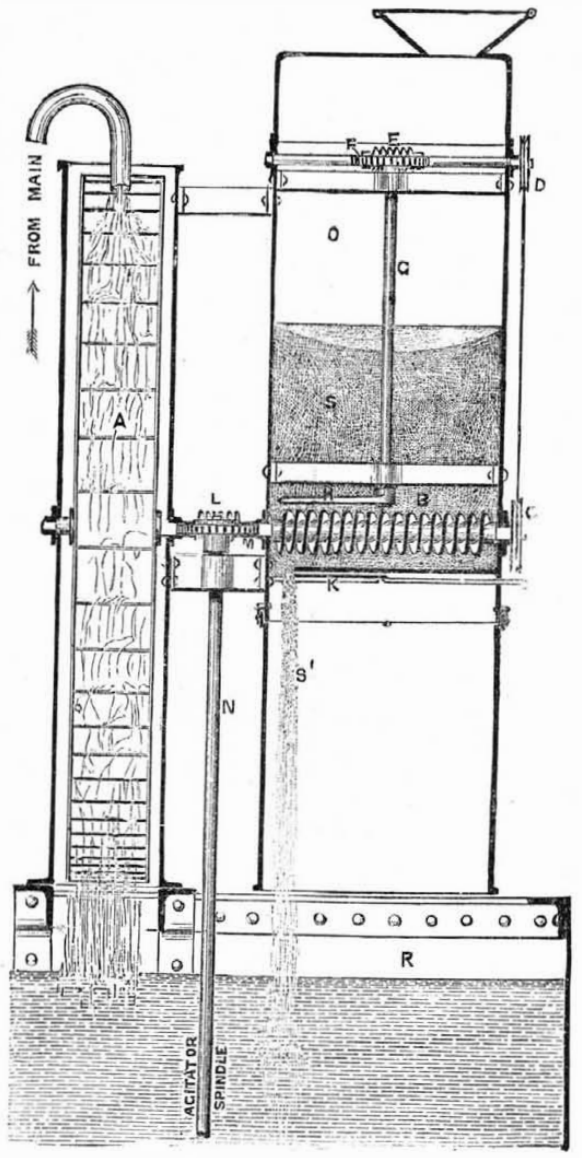

Fig. 2.-MAIGNEN'S APPARATUS.

Water is admitted from the main by a ball valve in the usual way, but instead of passing direct into the cistern, it flows through a pipe and is delivered over the small water wheel, A, shown to an enlarged scale in Fig. 2. This wheel is contained in a light iron casing open at the bottom, and is revolved by the action of the water as it passes into the cistern, the speed of revolution varying according as the supply is greater or less. The anti-calcaire powder is contained in the upper part of the circular casing, O, into which the spindle of the water wheel is extended in order to communicate motion to a small feeding worm.

In the bottom of the casing is an opening, the size of which is controlled by a slide, and as the worm revolves the powder is screwed forward to this opening, and falls in a greater or less stream into the cistern below. At the same time by suitable gearing the arm, H, agitates the powder so as to preclude the possibility of its hanging in the casing, and an agitator in the tank, worked by a worm and wheel, thoroughly stirs up the water, and produces an intimate mixture with the powder. As soon as the precipitate is formed a part of it sinks to the bottom, from whence it is removed from time to time by means of a plug in the bottom of the cistern. The remainder is carried forward with the water to the filter tank, where it is separated, and the clear, softened water passes on to the collecting reservoir. No labor is required beyond that for occasionally filling in the powder and removing the precipitates. The filtering frames will go for a couple of months without requiring attention, and are then readily cleansed in about half an hour by dashing water upon the cloths.

The engraving shows an apparatus for dealing with 12,000 gallons a day, the space occupied being 8 ft. by 4 ft. by 5 ft. high. A plant of this description is in operation at the Exhibition, softening the water for the aquarium and fish breeding tanks. Fish cannot be kept in hard water in a healthy condition in a confinedst ate, and at the beginning of the Exhibition, when the ordinary water was being used, a white fungus was observed on all the fish, and many of the young ones died. As soon, however, as the softening process was got to work, the fungoid growth disappeared, and the fish became healthy. Mr. Maignen's process is now in course of introduction in several large and important establishments, and will very soon be in operation at the new works of the Southwark and Vauxhall Water Company at Battersea. For drinking water the hardness can readily be reduced to 1½ deg., but for dye works and ordinary washing and manufacturing purposes 4 deg. or 5 deg. generally answers sufficiently well. One of the chief advantages of anti-calcaire is the perfect control it gives, as, by varying the composition or quantity of powder used, the result can be adjusted so as to meet every different requirement.

A Flowing Well near Lockport, N. Y.

Adam Ruhlman & Son have a pond on the Wakeman farm from which they supply ice to Lockport and other places. This fall they decided to increase its capacity, and drilled an artesian well to flood it. The drill passed through 114 feet of solid limestone rock, when it struck a water seam from which the water spouted high above the top of the well, and has been flowing at the rate of 25 000 barrels of ice cold water a day. It is one of the greatest artesian wells in existence.

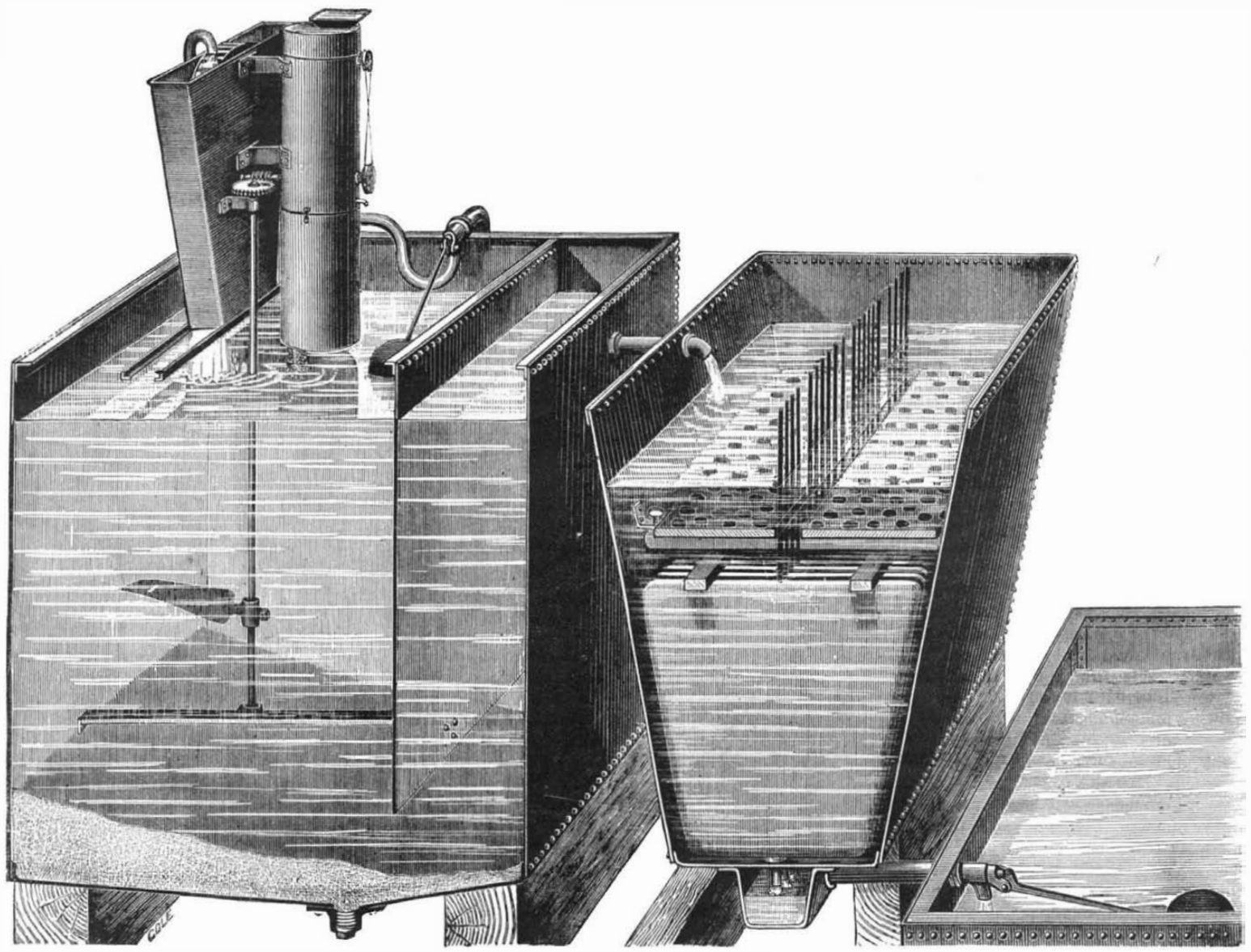

Fig. 1.—MAIGNEN'S WATER SOFTENING APPARATUS.

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Power of Water to Move Gravel.

Mr. A. Del Mar writes from San Francisco to the London *Mining World:* I notice with pleasure that English mining capital is more and more attracted to hydraulic mining. It is the surest kind of mining, because you can thoroughly prospect the ground beforehand. By means of a common ground auger, costing a few pounds, and a couple of men, whose wages will not exceed a few pounds more, you can determine in advance the entire auriferous contents of a mine. It is the most profitable kind of mining, because the cost of washing a cubic yard of gravel rarely exceeds sixpence, and usually varies between one and two pence sterling; while the yield of gold is rarely less than sixpence, and usually varies between one and five shillings per cubic yard. It requires less capital to be sunk in machinery than any other kind of mining. The entire outfit consists of a wrought iron pipe and nozzle to bring the water in, and wooden sluice boxes to wash the gravel in. The pipe is always good for what it cost; the sluices boxes can be reduced to boards, and in that condition will readily fetch half price.

The discrepancies that appear in the prospectuses of certain hydraulic mines capitalized in England concerning the power of water to move auriferous gravel induce me to offer a few remarks. There can be no general rule on this subject, because there is no general hardness of gravel. In many of the placer mines of this State, in the old Roman mines on the river Quiroga, of Spain, and in some of the ancient placers of the Piedmont country in Italy, the gravel is exceedingly hard. Miners call it "cement." Its texture is that of cemented rubble, and only the heaviest streams of water can break it down. In other of the placer mines of this State, in those of the Rio Grande of Brazil, and in those of the river Boeza in Spain, the gravel is exceedingly soft. It runs so easily that water having no pressure at all will break it down. At the Hathaway Mine, Nevada County, Cal., I have directed a 500 inch head of water, with 300 feet of pressure, upon a gravel bank for ten or fifteen minutes before it showed signs of yielding. At the Bahu Mine, Brazil, I could not get from the existing ditches more than 80 feet of pressure, and yet this broke the bank down faster than I could wash the dirt in the sluices. To call this Brazilian stuff gravel is a misnomer. It is a fine red dirt, of the color and almost the fineness of snuff.

Between these two extremes there is every conceivable grade of gravel. There is also a great difference in the pressure of water, and, therefore, a vast range of efficiency on the part of water to move gravel. A few instances will afford some idea of how much this differs. There is a small hydraulic opening in Placer County, Cal., where the pressure of water is only 60 feet, and the quantity of water moved per miner's inch of water is only one cubic yard. At the North Bloomfield mines (now closed by injunction of the Supreme Court), the pressure of water varied from 180 to 260 feet, and the quantity of gravel moved averaged about four yards to the miner's inch. At a gravel mine in El Dorado County the pressure was 350 feet, and this moved twenty yards of gravel to the inch of water. At the mines of Santa Lucia, Brazil, the property of Prince d'Eu, I moved twenty-five yards of gravel to the inch of water, the pressure being about 112 feet. In the mines of the Boeza, the pressure being 150 feet, and the gravel loose and uncemented, I calculated the work of water at ten cubic yards to the inch. In San Bernardino County, where I am erecting some works at the present time, I am to have a head of 200 feet, and the gravel being loose and friable, I have estimated on twenty yards to the inch. The sluices are of ordinary grade.

How to Make Battery Carbons.

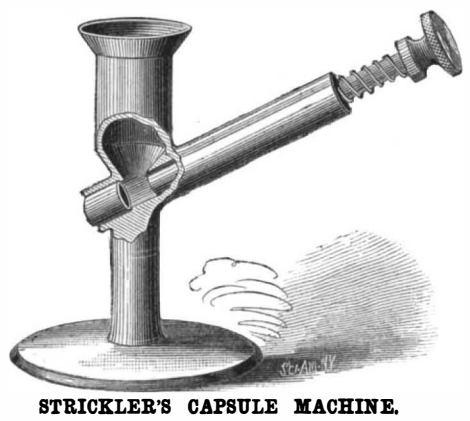
The *English Mechanic* tells a correspondent how to make carbon candles: Take, for instance, a carbon for use in an ordinary 5 x 7 Fuller or Bunsen battery. Make it, say, 2 x 8½ inches. Procure two pieces of sheet iron or brass, preferably brass, but the former will answer, 3 x 10 inches, not less than ¼ inch thick and perfectly flat. Then make, or have made, from a rod of metal ½ inch square and about 22 inches long, a rectangular frame of three sides, whose internal dimensions will be 2 x 10 x ½ inch or thereabouts. These three pieces constitute the mould, and in order to complete it, it only remains to place the U-shaped frame between the two plates, fastening the whole firmly together by means of screw clamps, and you will have an oblong box, open at one end. See that the parts fit as closely as possible. Next pulverize in an iron mortar a quantity of gas retort carbon or common coke, taking care to have a little more than is sufficient to fill the mould. The finer the coke powder, the better. Place it in a glass or earthenware dish, and pour upon it a small quantity of sirup or dissolved sugar. Mix and knead the mass thoroughly with the fingers, adding by degrees a little of the sirup until it becomes sufficiently moist to bind well when pressed together.

Set the mould on end, drop in enough of the mixture to fill it about one-third, and stamp it down lightly with a ¼ inch rod. Continue the operation until the mould is full, then get a piece of wood or metal nearly large enough to fit the mould, for use as a rammer. Place one end in the opening, and strike it smartly with a mallet. The mass will be driven down about 2 inches and tightly compressed. With a little water mix up some plaster of Paris to the consistency of dough, and press it into the opening, having previously removed the rammer. Force it down, and continue adding the plaster till the end is thoroughly closed. The contents of the mould are now ready for the "carbonizing" process. Make a good coal fire, place the mould upon it, and expose to a red heat for an hour or more. Allow it to remain until the fire has gone out. When cold enough to admit of being handled by the fingers, remove it, and if the experiment has been properly conducted, you will find the carbon complete.

It is true that a carbon made in this way is not so dense as the commercial article; but for ordinary battery purposes it will be found equal to any, and all that can possibly be desired.

CAPSULE MACHINE.

The engraving shows a machine recently invented by Mr. J. Strickler, of 297 Main Street, Poughkeepsie, N. Y., for filling gelatine capsules with quinine or other dry medicinal powders. The powder passes from the hopper into the filling tube, placed transversely below the hopper and inclined to the horizon, to facilitate the fall of the powder toward the end of the tube in which the capsule is held. The



STRICKLER'S CAPSULE MACHINE.

plunger works within the filling tube from its back end. There is a button on the back end of the plunger for forcing it forward, the motion being arrested by a collar striking the back end of the tube. The plunger is forced outward by a spiral spring. The capsule rests in a recess somewhat larger than the remaining portions of the tube.

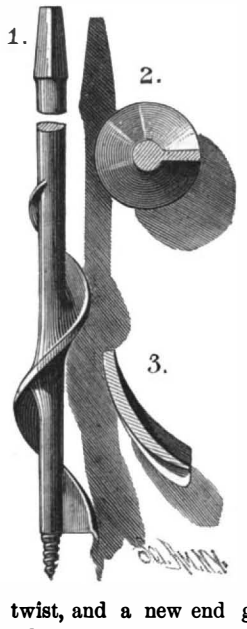
The capsule is held in place by the finger of one hand, and the plunger pressed down by the other. This forces the powder into the capsule, and the operation is repeated until the proper amount of powder has been put in. The forward end of the plunger is made slightly concave, for the purpose of leaving a convex surface on the powder to fit the cap when put on the filled capsules. When properly filled, the capsule may be expelled by pressing the plunger inward to its full extent. The return spring motion of the filler gives it an easy and quick filling action, and as the plunger passes beneath the hopper there is no liability of the powder clogging.

Peculiar Result of a Mill Accident.

The Duluth *Tribune* makes the following statement: "It was more than three weeks ago that John Johnson, a laborer in the Duluth Lumber Company's mill, was injured by being struck in the head by a stick flying from a saw The stick broke the skull just over the left eyebrow, and when Dr. Davis dressed the wound he took out a piece of the skull about an inch and a half large, exposing the brain. For some time Johnson's recovery was very doubtful, but he improved, and is now doing well. The peculiarity of the case lies in the fact that the wound has not entirely healed yet, and that it appears as though it would not heal; for the wound reached the nasal cavity, and now the patient actually breathes through that hole in his skull—that is, he can breathe so when he chooses to. He is now doing well, and promises to fully recover, except that he will always have the choice of breathing through his pose, his mouth, or the hole in his forehead."

IMPROVED AUGER BIT.

The single twist blade is an integral portion of the bit, and constitutes a quick, flat screw thread around the solid center stem that terminates at its forward end in a gimlet screw. The advance edge of the blade has a sharp cutting edge, Fig. 3, and spread sharp lips. It will be seen from this that the bit has but one edge or side cut. A hole can be easily, speedily, and smoothly made with it, and as the passage for the chips is larger than in the ordinary double-twist drill, a quicker and readier escape is allowed them, thereby reducing the liability to choke. Greater facility is also afforded for sharpening and repairing the bit. As it has a solid central stem, the bit may be broken or cut away at any point in the twist, and a new end gimlet screw and cutting edge formed.



This invention has been recently patented by Mr. W. M. Dimitt, and particulars can be obtained from Mr. C. H. Irwin, of Martinsville, O.; it is applicable to hand and machine augers.

Vegetable Culture in Bermuda.

Consul Allen says that onions, potatoes, and tomatoes comprise almost the entire production of Bermuda, and give employment to the greater portion of the inhabitants, and the prosperity of the colony depends largely upon the success of the crop and the demands of the markets. In onion growing the seed used is grown in the Canary Islands, and is imported in the months of August and September; it is sown in the months of September, October, and November, thickly in beds, the ground having been heavily manured with stable manure two or three months before sowing. The white seed is sown first, and produces the earliest crop, the shipment of which commences in March. When the plants are sufficiently large—about six to eight inches high—they are transplanted into beds about four feet wide, the plants being set about seven inches apart each way. The plants from the white seed are transplanted as soon as they are large enough, but those from the red seed are not usually transplanted until the beginning of January, and the ground requires to be only moderately manured. If transplanted too early, and the soil is too rich, the bulb is likely to split into several pieces, and is worthless. After transplanting, the soil requires to be lightened once or twice, and the weeds removed before they mature. As soon as the top begins to fall, the onions are pulled and allowed to lie on the ground for two or three days, when they are cut and packed in boxes of fifty pounds each and sent to market. All the onions are delivered at the port of shipment in boxes, ready for the market, and for the past two years the producer has been compelled by law to place his name or initials conspicuously on each package. It is estimated that a large profit on the outlay is realized, when the crop is large and the market good, an acre of ground sometimes returning as much as £120 to £170.

For the cultivation of potatoes the seed was formerly nearly all imported from the United States, but of late years has come largely from New Brunswick, Nova Scotia, and Prince Edward's Island. The ground for potatoes is usually plowed or broken up with the spade and raked, the seed cut into pieces with one or two eyes, and planted by forcing into the ground with the fingers to the depth of about four inches, in rows about twenty inches apart, and about eight inches in the rows. From six to eight barrels of seed are used to the acre. When the plants are a little above the ground, the soil is lightened between the rows with a fork, and when about six inches high the earth from between the rows is hoed round the plants, only one hoeing being required. For growing tomatoes the seed is imported every year, and is sown about October, and transplanted in December, into rows about six feet apart, and the plants are put about four feet apart in the rows. As soon as transplanted, the ground round the plants is covered thickly with brush—chiefly the wild sage which grows over the hills—not only to protect from the wind, but to keep the fruit from the ground. The brush is usually raised once by running a stick under and lifting it enough to clear the soil of weeds, no other cultivation being required. Six or seven quarts of fruit from the hill is considered a fair crop. The fruit is rolled in paper, and packed in boxes containing about seven quarts each. Consul Allen says that the price of land in Bermuda varies from £30 to £40 an acre, and in some cases not more than one-eighth is susceptible of cultivation. It is estimated that there is an annual export of 350,000 boxes of onions, the box containing about fifty pounds, and of potatoes 45,000 barrels.

Excavating in Quicksand by Freezing.

By a comparatively recent invention of Herr Poetsch, a Prussian mining engineer, the work of sinking shafts, and possibly other difficult work in tunneling and excavating in quicksands, has been greatly facilitated. The plan is to actually freeze the sand or running ground, for a little larger section than is required to be excavated, so that it can then be worked as in solid rock until the permanent walls are built up. This is effected by putting down bore holes, lined with iron tubes closed at the bottom, as near together over the whole section to be worked as deemed necessary for the rapidity of work desired, and circulating through these and interior cotton tubes a freezing mixture. A brine composed of chlorides of calcium and magnesium, having a freezing point about 36° below F., is caused to circulate through these pipes by a small force pump, abstracting heat from the surrounding water-bearing stratum until it is frozen into a solid mass.

An interesting illustrated description of this apparatus and its working will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 420.

Trade Marks.

A foreign contemporary has discovered that trade marks are nearly as old as the industry of the human race. Ancient Babylon had property symbols, and the Chinese claim to have had trade marks 1,000 years before Christ. Gutenberg, the inventor of printing, had a law suit about a trade mark, and won it. As early as 1300 the English Parliament authorized trade marks, and the laws of America have also protected them. Extraordinary means have been required at all times to guard against the fraudulent use of marks of manufacturers. If we have no means of identifying the trade mark, the best goods at once lose their value. This was early discovered, and probably the successors of Tubal Cain were the first to use distinctive marks on their productions.

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Correspondence.

There are Cats in Leadville, but no Chinamen.

To the Editor of the Scientific American:

In your issue of Nov. 4, I notice the statement made by your exchange that there are no cats in Leadville. This statement, which has pretty well gone the rounds of the papers, I know from personal knowledge to be untrue, for there are cats here, as well as rats and mice. It is true this is not a healthy place for cats, for more than half of those which are either brought or born here die of fits. One thing is certain: they do not die of any lung trouble, for although we are some 10,000 feet nearer heaven than our average fellow man, we hear something else at night than angel voices.

There is one thing that does not live here, and that is a Chinaman; not that his health would not stand the altitude, for he has had no chance to try it more than a hour or two at a time, but the last one that came to try the climate went out curiously examining the end of his queue, which had previously been attached to his head. H. W. H.

Leadville, Colorado, Nov. 7, 1884.

A Wonderful Ancient Aqueduct.

Dr. Ernest Fabricius, a member of the German school at Athens, has given an account of the ancient aqueduct at Samos, described by Herodotus (book iii., cap. 39–60). The aqueduct was constructed during the sixth century B. C., after designs by Eupalinos, a Megarean architect. Dr. Fabricius' account is as follows:

The aqueduct falls naturally into four divisions: 1. The spring itself, with the building over and about it. 2. The portion of the aqueduct leading from the spring to the intervening hill. 3. The tunnel proper through the hill. 4. The aqueduct from the hill to the town.

Fortunately, about the spring itself there had never been any difficulty. There is only one spring of any considerable size that did correspond to the "Great Spring" of Herodotus. This spring is marked by three chapels to St. John, known among the natives of the island as the "Hagiades." There is no doubt, therefore, whence the aqueduct started. It is between this spring and the port of Samos, the modern Tigani, that the mountain ridge intervenes. Never was a town worse situated with respect to its water supply. Either the mountain must be tunneled or the water led round the base by a long, awkward circuit. Portions of the well house structure still remain, and are, in fact, still used by the natives. It consisted of a building in the shape of a right angled triangle, with a slightly rounded hypothenuse, the roof supported by fifteen pillars.

Second comes the portion of the aqueduct between the well and the tunnel proper. Here the conduit was about the height of a man, partly hewn out of the solid rock, partly built up out of masonry. It is about 853 meters in length. Lying about in this part have been found large quantities of cylindrical tiles, no doubt either the brick pipes mentioned by Herodotus, or at least their modern successors. Third, we come to the tunnel proper. The merit of having discovered the actual mouth of the tunnel belongs to the present abbot of the neighboring monastery of the Hagia Trias. For five months he and a fellow abbot of the monastery of Stauros superintended the labor of fifty workmen, and laid bare the entrance and a part of the tunnel itself. It would be much to the advantage of the inhabitants of the modern Tigani if the work could be completed, and they could be supplied with good drinking water after the same fashion as their ancestors of the time of Polycrates. Unfortunately, the investigation of the actual tunnel is still in part, owing to the insufficiency of the props, a matter of considerable danger. On the south side it is accessible for 500 meters, on the north for 100 meters. Except at the entrance and the exit, where it is supported by masonry, the tunnel is bored through the solid rock.

Abundant marks of hammer and chisel still remain, the work never having been finely finished. Along the walls niches are frequently found, and in some the very lamps remain which served to light the workmen. A little to the south of midway an interesting fact comes out. About 425 meters from the mouth, in a southerly direction, the tunnel ends in blank rock. It is clear that the boring was begun from the two sides of the mountain. A slight error was made, and hence one of the bores comes to this blank end. The error was rectified by digging down till the lower bore was struck, and, just as we should expect, we find that at the meeting point the tunnel is, instead of being just large enough for a man to stand upright, as high as 4 to 5 meters. At either end of the tunnel proper the walls are, as we said before, supported by masonry. On the north side much more masonry is needed for support than on the south. There is evidence that at first the supports were of wood, ultimately replaced by solid stone.

It is this third portion of the conduit, *i. e.*, the tunnel proper, that alone aroused the admiration of Herodotus. We remember he says that with the tunnel there is a second tunnel or dike 20 cubits deep. Such is in reality the case. The water does not flow through the tunnel, but in a deep ditch dug beneath it. It is at the bottom of this ditch that the brick pipes are laid. Unhappily, Herodotus gives us no clew to the reason of this curious and complicated arrangement. Dr. E. Fabricius conjectures that this second arrangement was made after the first tunneling, and in order to correct some error in the necessary level of the water supply. The tunnel seems to have been in use in Roman times; small chambers hewn in the rock seem to be Roman work. They supplemented the aqueduct, however, by a second supply of water brought round the mountain. We have also traces of early Christian influence. About 20 inches from the central meeting point of the two bores we come upon a small rock-hewn chamber, in which are a number of white marble pillars and some marble slabs, all much incrusted with stalactites. On one of these, when cleaned, were found unmistakable traces of a Byzantine style of ornament. No doubt the little chamber was used as a shrine. Last, we come to the fourth section of the aqueduct, the portion that leads from the tunnel exit to the town. The end of the main conduit has never been found; probably it came out near the shore, where good drinking water would be especially needed. Close to the harbor lay the ancient Agora, and according to an inscription found built into the walls of the modern Tigani, there was in this Agora a stoa which contained two elaborate klepsydræ, or water clocks, which told the water drawer's month, day, and hour. As there is no spring in the neighborhood of Tigani which runs the whole year round, we may reasonably suppose that these marvelous klepsydræ were worked by the water that came through the tunnel of Eupalinos. Possibly the tyrant Polycrates had a taste for the marvelous in the water clocks as well as rings.—*The Sanitary News.*

[FOR THE SCIENTIFIC AMERICAN.]

TELESCOPIC VIEWS OF VENUS AND JUPITER.

At the close of my night's work in comet seeking, I have of late given special study to the markings on Venus and

Fig. 1.—VENUS.

Jupiter. Venus is best observed in twilight with any telescope, but with the reflector a very superior view of this difficult object is obtained, owing largely to the absence of chromatic aberration in that instrument.

My observations have been made with the nine inch reflecting telescope, and often continued into broad daylight, or until within a few minutes of sunrise. It must be understood that these are all morning observations.

Fig. 1 is a telescopic view of Venus, showing some faint, delicate markings upon its half-illuminated face. All these markings are difficult to see by an observer who has not trained his eyes for the detection of faint objects, except the central marking, which I consider comparatively easy with telescopes of moderate aperture.

I have so seen it with the aperture reduced to five inches.

Fig. 2 is a telescopic view of Jupiter, showing the appear-

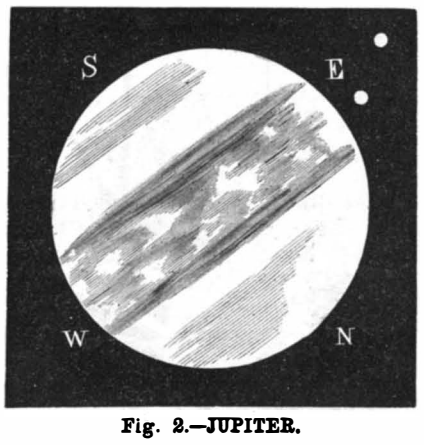

Fig. 2.—JUPITER.

ance of its interesting belts during the past three weeks. The north and south equatorial belts were of a bright copperish hue, the southern being twice as broad and much more intense in color than the northern one. The intermediate space, directly on the equator of the planet, was of a general dull purple color, quite faint, and mottled with large white spots, as I have indicated in the drawing.

The views are inverted, as seen in the telescope. In the upper right hand corner of Fig. 2 may be seen two of the four moons of Jupiter. WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y.,
November 3, 1884.

A MEETING of some fifty prominent business men of Pittsburg met the other day, and decided to organize a stock corporation, having a capital of $250,000, with the privilege of increasing it to half a million dollars, for the purpose of erecting and maintaining an exposition building in that city.

The London "Inventions" Exhibition.

It will be noticed by reference to our advertising columns that the time during which American inventors may apply for space in this exhibition has been extended from October 1 to the 31st of December. As its title indicates, it will be, we are assured, a most unique display, in no way like the many other exhibitions which have been and are constantly being held; for exhibits are to be strictly confined to illustrations of apparatus, appliances, products, and processes invented or brought into use since 1862. It will not, therefore, be a great bazar, with a bewildering variety of old and new things thus advertising themselves, but will rather afford high educational opportunities for thoughtful men and inventors, and be altogether more profitable in this way from its exclusion of all but that which shows the most recent progress. It is not to be wondered at, therefore, that the managers of this exhibition—which is held under government auspices—especially desire a full representation from the United States, for have not our inventors been conspicuously in the van of the world's progress during the past generation? But then our inventors can well afford in this way to bring the fruits of their genius before the best judges of England, and thus, in fact, of the world.

All necessary information as to space, etc., with printed forms, will be supplied by the Hon. Pierrepont Edwards, the British Consul in New York city.

The English patent law is now very liberal, but it is strict in requiring that applications for a patent shall be made before the invention is publicly made known there; and even before the description of the invention is put in printed form in this country, application should be made. Intending exhibitors who have not yet taken this precaution have no time to lose.

Human Vision.

Persons speak of their eyes being fatigued, meaning thereby that the seeing portion of the brain is fatigued, but in that, says Dr. W. W. Seely, they are mistaken. So men say their brains are tired. Brains seldom become tired. The retina of the eye, which is a part of the brain and an offshoot from it, hardly ever is tired. The fatigue is in the inner and outer muscles attached to the eye and in the muscle of accommodation. The eyeball, resting in a bed of fat, has attached to it six muscles for turning it in any desired direction, and the muscle attached to the side nearest the nose and one at the outer angle of the eye should, in every normal eye, be balanced. They are used in converging the eye on the object to be viewed, and the inner muscles are used the more when the object is the nearer. The muscle of accommodation is one which surrounds the lens of the eye. When it is wanted to gaze at objects near at hand, this muscle relaxes and allows the lens to thicken, increasing its refractive power at the same time that the muscles on the inner or nasal side of the eye contract and direct the eyes to the point gazed at. It is in these muscles that the fatigue is felt, and one finds relief in closing the eyes or in gazing at objects at a distance. The chief source of fatigue is the lack of balance in the two sets of inner and outer muscles of accommodation. It may be set down that there is something wrong when the eye becomes fatigued. The defective eye, as it gives out sooner, is really safer from severe strains. The usual indication of strain is a redness of the rim of the eyelid, betokening a congested state of the inner surface, accompanied with some pain. When it is shown that the eye is not equal to the work required of it, the proper remedy is not rest, for that is fatal to its strength, but the use of glasses of sufficient power to render necessary so much effort in accommodating the eye to vision. It is not good sense to waste time in resting the eye, and that practice does not strengthen it.

Eyes begin to age at about the tenth or twelfth year of life, when they have reached their full development. At the age of forty-five or fifty years the lenses cease to thicken, when the pressure is removed and their presbyopia, or old sight, begins. When a child is compelled to use or require the use of glasses, there is little reason to hope that it will outgrow the need; but the person will use these glasses as a basis, adding other glasses as he reaches the age when old sight begins, or using thicker glasses. Dr. Seely, however, mentioned one case he had observed where a child had outgrown the need of glasses, but in the mean time he had grown from a small and puny child to a large and well developed man.

Second sight, or the apparent recovery of strength of vision, which is sometimes seen in the aged, the lecturer explained as a change, an elongation, in the shape of the eyeball, by which the person became nearsighted, accompanied by a change in the lens caused by the appearance of cataract.

The Wealth from Inventions.

Senator Platt, in his vigorous speech in Congress last winter in support of our patent laws, claimed that two-thirds of the aggregate wealth of the United States is due to patented inventions. That two-thirds of the $43,000,000,000 which represents the aggregate wealth of the United States rests solely upon the inventions, past and present, of this country.

Mulhall, in his "Progress of the World," writes that in effect the invention of machinery has given mankind an accession of power beyond calculation. The United States, for example, make a million sewing machines yearly, which can do as much work as formerly required 12,000,000 women working by hand. A single shoe factory in Massachusetts turns out as many pairs of boots as 30,000 bootmakers in Paris.

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OTTO GAS ENGINES AT THE PHILADELPHIA ELECTRICAL EXHIBITION.

The application of the "Otto" engines to electrical purposes has grown very much during the last year, and at the exhibition three different sizes of engines are shown in connection with incandescent plants—one 4 horse power engine running 25 Edison lights and one 7 horse power engine running 40 Bernstein lights. Both these engines are of the usual type, so well known for its simplicity; and while with it impulse takes place only once for two revolutions when fully loaded, or even for many more revolutions when partially loaded, they are run under the control of a sensitive governor and under the influence of the momentum of well proportioned fly wheels in a manner to produce all that is required with respect to regularity to drive incandescent machinery

A twin engine of the Otto type is also exhibited, indicating 15 horse power and producing under full load an impulse at every revolution; but as the exhibitors, Messrs. Schleicher, Schumm & Co., propose to show the practicability of their single cylinder engines, and most simple construction for incandescent lighting especially, the twin engine, whose less simple construction seems naturally to secure a higher degree of regularity, was not considered worth while to be brought to a test, and is not connected to any electric machine

The power for electrical lighting being used at certain times in the evening only, an engine which is started without lengthy preparations, needing no boiler, and whose running expense is limited to the time of use only, seems not only very suitable, but renders incandescent plants practical in residences and halls not connected with the wires of an electrical station.

It is also important that in such cases the motor used possesses the greatest simplicity in parts, making it possible that domestics ordinarily employed about a household can assume its management.

In this respect, the application of a single cylinder gas engine is preferable to more complicated variations in construction. Besides the purpose of electric lighting, the Otto engine is much used for other electrical work. The small sizes are driving the commutators in our leading telephone offices. The Philadelphia Local Telegraph Company create, with a 10 horse power Otto and Edison dynamo, the necessary current for about 400 instruments, for brokers' and other offices in Philadelphia and New York.

Otto engines are also used for metal plating by electricity, electrotyping, for photography with electric light; and the electrical railway worked along Brighton Beach in England, about one mile in length, has its current produced by an 8 horse power Otto. The fact that this electric railway is a paying enterprise is certainly in part due to the use of such an economical prime mover.

Exporting Steel Rails.

According to the *Railway Review*, for the first time in the history of our rail mills they have made a large sale of steel rails abroad. The Lackawanna Iron and Coal Company has contracts to deliver 10,000 tons of steel rails at Brockville, Canada, for the Canadian Pacific at a figure varying not far from $28 50 per ton. It is not so very long ago that we were importing steel rails to a not inconsiderable extent, and our ability to now turn about and compete successfully with the mills from which we have so recently bought indicates the existence of possibilities in an export trade in steel rails that should not be lost sight of.

NEW GRIP SYSTEM FOR ELECTRIC RAILROADS.

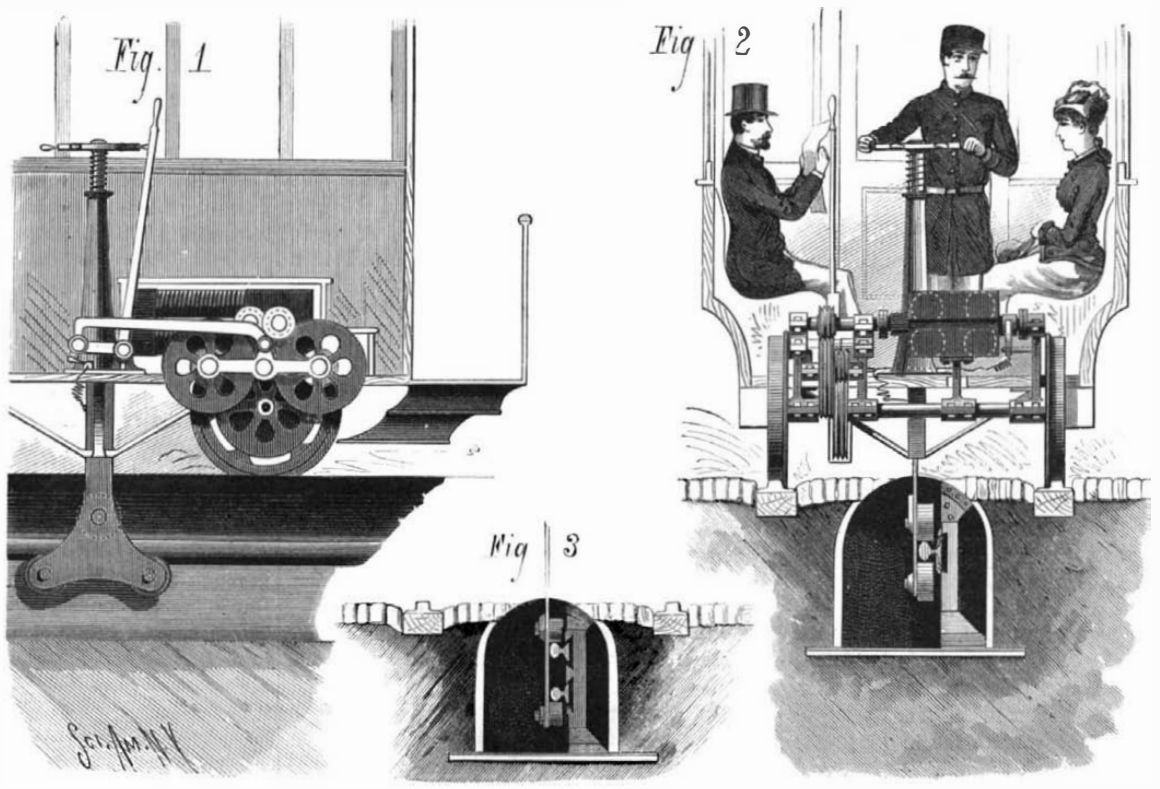
In the earlier electric railroads the general plan was to use the rails as conductors, and while, theoretically, this was the best and cheapest way, in practice it was found to possess many disadvantages—perfect insulation was difficult, and good contact between the rails and wheels was not always to be obtained because of mud, ice, etc. In addition, there was danger that animals might come in contact with the rails. No matter how powerful the current used, the tractive force was limited to the weight of the car, and, of course, any attempt to carry extra weight to overcome a grade would result in additional expenditure of power on a level.

In the system of Mr. John C. Henderson, Civil Engineer of this city, in case of danger one movement of a lever instantly throws the whole tractive force in the opposite direction with the full power that is being used at the time, irrespective of the motor car. The car can be reversed and run back, as when overrunning a switch, and in case of a large conflagration in the city the road can be kept in operation by simply introducing two or three crossovers in the length of the line. The conduit can be constructed of iron, concrete, or timber, according to the locality, and having no movable cable running through it the extra space can be used by electric light and other wires.

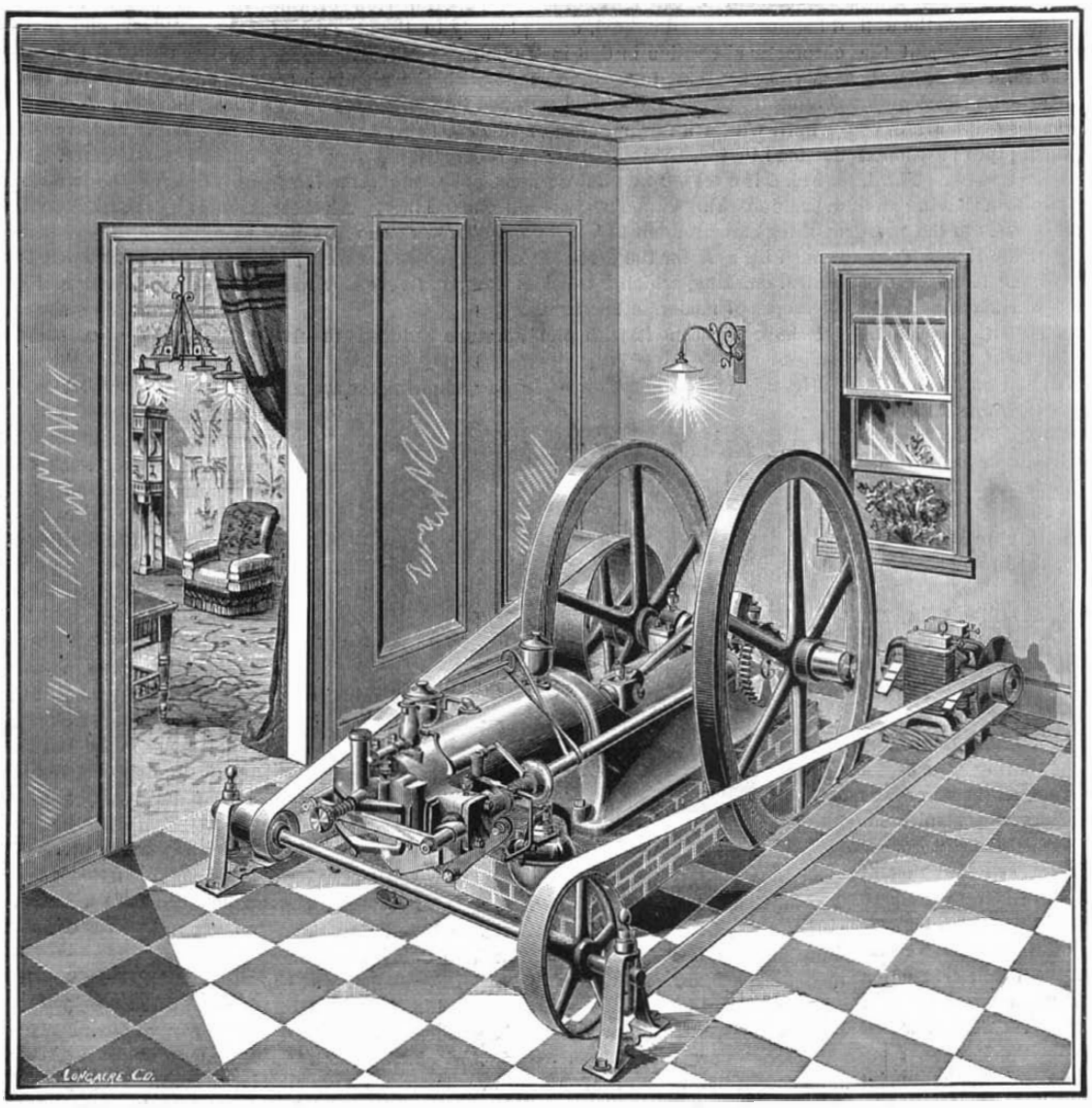
This system is very simple in construction, as will be seen from the engravings. A fixed bar or bars are supported according to requirements in a conduit beneath the track, in the same manner as in the cable system, and are insulated by chairs or shoes at the supports. The grip takes hold by rollers under the bar; the grip shaft passes up through the bottom of the car, and upon its upper end screws a hand wheel. By turning this wheel in a direction to raise the grip, all the tractive power required can be obtained. The grip also conveys the current to the motor, and back from and to the bars, as the case may be or the locality require, since in some instances it may be advantageous to use only one bar, the return being obtained through both rails and the iron conduit.

By means of a lever the electric motor can be shifted so that a pulley upon the armature shaft having a V-shaped face will be in contact with similar pulleys driving the axle; by this means the direction in which the car is moving can be changed without interfering with the current.

Further particulars regarding this system may be obtained of J. C. Henderson, 2 Liberty Street, New York city.



NEW GRIP SYSTEM FOR ELECTRIC RAILROADS.



THE OTTO GAS ENGINE AT THE PHILADELPHIA ELECTRICAL EXHIBITION.

Chilled Roll Casting.

Messrs. Taylor & Farley, the well known roll makers of the Summit Foundry, West Bromwich, England, have just completed a very large pair of chilled rolls for Messrs. Bolckow, Vaughan & Co.'s new plate mill at the Eston Steel Works, Middlesborough. The rolls referred to are 30½ inches diameter, finished size, and have been cast with a hole through the center, this hole being about 7 inches diamete in the middle part of the roll, and tapered down to a smaller size at the neck and wabbler ends, in accordance with the design of Mr. Franklin Hilton, the steel company's engineer. These rolls have been so cast hollow with the object of counteracting the unequal expansion and contraction which is so frequently the cause of the breakage of chilled rolls, having regard to the well known difficulties inseparable from the casting of chilled rolls, more especially rolls of large diameter—difficulties which are increased by coring out. On being turned, these rolls presented a splendid working surface with a perfectly regular chill three-quarters of an inch deep, and are absolutely free from blow-holes or other defect; indeed, they will stand microscopic inspection. Experienced manufacturers of iron and steel who have inspected these rolls have pronounced them to be a magnificent pair. The large and powerful plate mill above mentioned was successfully started on the 16th of October, in the presence of Mr. Bolckow, Mr. Windsor Richards, and a number of other gentlemen of eminence in the steel and iron trade.

Cholera Boxed Up.

It is said that two doctors of Marseilles fancy that they have succeeded in discovering the morbid agent of Asiatic cholera, which, according to their statement, is a "mucor" entirely distinct from the "comma" of Dr. Koch. Considerable amusement was created at the Academy when the perpetual secretary, Professor Beclard, exhibited the sealed box which contained preparations and specimens of the offending "microbe." Amid a general burst of laughter, the president was requested "to keep the box sealed." Thus does the spirit of comedy invade the ground of tragedy even in the most serious of human affairs.

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Varnish for Patterns.

A varnish has been patented in Germany for foundry patterns and machinery which, it is claimed, dries as soon as put on, gives the patterns a smooth surface, thus insuring an easy slip out of the mould, and which prevents the pattern from warping, shrinking, or swelling, and is quite impervious to moisture. This varnish is prepared in the following manner: Thirty pounds of shellac, 10 pounds of Manila copal, and 10 pounds of Zanzibar copal are placed in a vessel, which is heated externally by steam, and stirred during four to six hours, after which 150 parts of the finest potato spirit are added, and the whole heated during four hours to 87° C. This liquid is dyed by the addition of orange color, and can then be used for painting the patterns. When used for painting and glazing machinery, it consists of 35 pounds of shellac, 5 pounds of Manila copal, and 150 pounds of spirits.

The Probert Process.

We glean from the *Mining and Scientific Press*, of San Francisco, the following details of this new process for separating gold and silver from arsenide and sulphites of iron and copper by the use of litharge or lead when in a state of fusion in a certain manner which Mr. Edward Probert, of Eureka, Nevada, has patented, including a method of stirring or agitation of the molten matter by the steam developed in the action of that mass upon certain substances in the following way:

Iron pots, of a conical shape, about thirty inches deep, thirty inches wide at top, and rounded off at the bottom spherically to about twelve inches in diameter, each capable of holding fifteen cwt. (more or less) of the substance to be treated, are coated with a lining of refractory material, composed, preferably, of decomposed or pulverized lava, pumice, or other volcanic rock, but when this is not obtainable, of silicious sand, with a certain admixture of finely pulverized limestone or calcareous marl, to which has been added a sufficiency of clayed water or milk of lime to work the whole into a paste. After laying on this internal coat of refractory material (intended primarily to protect the pot from corrosive action) to the thickness of about three-quarters of an inch, a further portion of a specially prepared composition, consisting of coarsely crushed limestone, dolomite, siderite, or other suitable carbonate, mixed with a sufficient quantity of ordinary composition with which pot is lined to give it consistency, is laid on the bottom of the pot to the thickness of one inch, more or less.

The pots thus prepared are placed in a suitable oven or chamber, or a small fire is placed inside each pot, to dry coating, which, however, is not to be baked so as to expel the last portion of moisture, but only so far as to remove excess of water. When required for use, pots thus lined and partially dried are placed in succession under spout of smelting furnace containing substance to be treated in a state of fusion, which is then tapped into them, while at the same time, or immediately afterward, a charge of lead or litharge, preferably granulated, is fed into each pot from a hopper conveniently placed above.

First effect of molten substance tapped from furnace into pots, is to convert small amount of moisture contained in protective lining of pots into steam, which, rising upward from bottom and the sides, causes a brisk ebullition of molten material. This treatment is insufficient in itself to effect the thorough stirring and blending of the contents of the pot necessary to assure a successful result; but no sooner is this first ebullition, due to the escaping steam, over, than the limestone, dolomite, or other carbonate fixed in the bottom of the pot, as well as the calcareous matter in the whole lining, begins, under the intense heat of the molten charge, to undergo calcination, and streams of carbon dioxide are sent off, which, rising upward through the molten matter, produce the effect of a small geyser. This keeps the charge in a state of ebullition and agitation for a period of time proportionate to the quantity of mineral carbonate or other source of carbon dioxide originally used in preparing the pot, and thus effecting such complete blending and intimate admixture of the ingredients as cannot be attained in any other way.

Duration of ebullition, and consequently stirring process, may be regulated to any required number of minutes, from five upward, or as long as the molten material continues hot enough to exercise a calcining effect on the limestone, etc.; and inasmuch as the carbon dioxide produced comes off in a steady stream without sudden bursts, as from the vapor of water, there is never any danger to the workmen from explosions. After ebullition is over, the pot with its contents is set aside to cool, when the lead settles to the bottom, carrying down with it the precious metals, and, when solidified, the mass of alloy can be detached from the waste matter and treated by cupellation in the usual way for the separation of the silver and gold. It will thus be seen that the stirring is effected partly by steam, which, however, can never be made to do the whole work, being too violent in its action, and causing trouble when too much moisture has been left in the composition, but chiefly by the carbon dioxide ("carbonic acid," so called) developed during the calcination of the limestone or other carbonate employed as the source of gas or vapor.

Railroad Subsidies in Mexico.

A contemporary says that the Mexican press do not look kindly upon the granting by government of subsidies to railroads, and one of them says, what the press might with one accord say here, that "all railway lines which are worth building ought to be able to command private capital to carry them into execution. If they cannot do this, they should not be built at all. It is the height of folly to cover the country with a net-work of 'wild cat' railways which traffic prospects for a half century to come will not justify. Several of these lines might be mentioned, which through their subsidies are in reality built by the government and made a present to the owners."

CHOLERA MORBUS.

The ingenious artistic combination represented in our engraving, is the original drawing of the Italian artist Gallieni; seen at a little distance, it represents a fleshless skull

CHOLERA MORBUS.

with its black eye sockets and grinning teeth; a nearer view of it shows two beautiful children who are playing with their infant toys and caressing the faithful dog, and whose heads occupy the central part of a window.

Gallieni has given to his composition the fearful title of cholera morbus, and he explains it in brief words as follows: Fear increased by the imagination is the best friend of the guest of the Ganges.—*Ilustracion Espanola.*

Luminous Paint.

Luminous paint continues to make slow but steady progress in its application to innumerable useful purposes. Among its most recent applications may be mentioned tapes for field use at night by the Royal Engineers' department. Starting from a given point toward the front, the men leave a trail of luminous tape on their track, and on reaching a given point they mark the contour of the earthworks to be executed by the same means, paying out the tape as they return toward the camp. The working party then follow the outward trail, execute the work, and return to camp without having discovered a single ray of light to the enemy. The German War Office authorities have experimented with the paint for purposes of night attack, and Lieutenant Deppe, of the Belgian School of Gunnery, is investigating its merits in the same direction. Our own government, says the *Building and Engineering Times* (London), are also using painted framed glasses, or Aladdin's lamps, as they are called, for internal boiler inspections. General Lord Wolseley also took with him a luminous compass for the Nile expedition. It has also been applied in some large establishments to the fire buckets, which are thus easily found in the dark. A South-Eastern Railway third-class carriage has the interior lined with the paint on the back of glass.

Fishing in Jalisco, Mexico.

Consul Lambert, of San Blas, gives the following account of the methods employed in fishing in Jalisco. The fibrous roots of a small shrub called *varbasco*, which grows wild in the neighborhood, are procured, and after being well broken up, they are placed in the bottom of the canoes. At high tide the fishermen proceed to the mouths of the *esteros* (small creeks), and erect a wooden fence. They then partly fill their canoes with water, which produces an intensely white liquid from contact with the root. Arriving at the source of the *estero*, or in some shallow places beyond which the fish are not likely to go, the preparation is thrown into the water, which also turns perfectly white. The effect of this is that the fish are blinded, and in a very short time they are found floating on the surface of the water at the fence erected at the mouth of the *estero*. The larger ones are then gathered into the boat, and taken to market.

Another method which is more fatal in its effects, though it is performed less frequently, is the employment of the milk of the *ava* tree. This tree yields, when tapped, a white liquid very much resembling the juice of the India rubber tree. It is used in the same manner as the *varbasco*, and not only blinds, but kills the fish instantly. Fish killed in this manner have to be used immediately. In neither case is there any visible sign of the manner in which the fish have been killed. There is a law in existence against the use of poisons in procuring fish for market, but it is practically inoperative and void, for the reason that there is no defined method for determining the death of fish by these liquids, and the natives who take them in this manner are careful that each fish shows a spear hole in the back before landing it; and in the absence of any method of detection, the spear hole is *prima facie* evidence that they are not poisoned. Consul Lambert says that, as far as he has been able to ascertain, no bad effects from eating fish killed in this way appear to be known.

A Powerful Gun.

M. Dupuy de Lome recently called the attention of the French Academy of Sciences to a new piece of ordnance of superior power which has been constructed by the Societe des Forges et Chantiers de la Mediterranee for the Spanish Government. It is a naval gun of 16 centimeters caliber, having a *bouche a feu* made according to the designs of General Honoria of the Royal Spanish Naval Artillery, and on the principles which the Societe des Forges et Chantiers have laid down to prevent unbreeching. The caliber of the piece is 161 millimeters; the diameter of the powder chamber, 200 millimeters; the length is 5,890 millimeters; the weight, 6,200 kilogrammes; and the weight of the projectile is 60 kilogrammes; the charge of powder is 32·5 kilogrammes; the velocity of the projectile at the muzzle, 632 meters per second; the maximum pressure with the powder used, 2,250 atmospheres; and the maximum thrust along the axis measured at the widest part, 706,000 kilogrammes. The kinetic energy of projectile at the muzzle is 1,222 tonneaux meters, and the ratio of the kinetic energy of the projectile to the weight of the cannon is 197, whereas with the 16 centimeter piece of the French Marine this ratio is only 168, that of the six inch British No. 3 is 168, while the Krupp 15 centimeter gun gives 153 for the same ratio. The recoil lasts for 0·21 of a second, as measured by Sebert's velocimeter, and is limited to 70 centimeters.

A Water Pipe Shock.

A singular occurrence, which is stated to have recently taken place at Ithaca, N. Y., illustrates the dangers attendant upon the universal introduction of electricity. As a lady was turning on the water from the faucet over the sink in her kitchen, using her right hand, her left hand being in contact with the iron lining of the sink, she was suddenly prostrated by a severe shock. Her impression was that she had been stricken with paralysis or apoplexy, but a physician who was summoned found that the inside of the thumb of the left hand had been blistered in several places. This led him to believe that she had received a strong electric shock from some source. A few minutes subsequently the lady's daughter, in drawing water from the same faucet, was similarly affected, though not so severely. The family then became convinced that the trouble existed in the water pipe and sink. The manager of the Telephone Exchange, after a brief examination of the premises, found the secret of the trouble. The residence was connected with the Ithaca Hotel by a "dead" private telegraph wire. This wire had been crossed with the electric light wire. The "dead" wire was connected with the metallic roof on the dwelling house, which in turn was connected by a tin water conductor with the water pipe leading to the sink. When the dynamo machine of the electric light company was in operation, the current passed over the "dead" wire to the tin roof, and thence to the water pipe. It needed only the completion of the circuit by some person drawing water.

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Egotism in the Shop.

The opinionated man is likely to be a disturbing force wherever he may be placed, but nowhere is he more objectionable than in the factory or shop. There he is a bar to progress, a foe to improvement, unless perchance the progress or improvement lies in the direction of his own inclination or belief. Every man is entitled to a wholesome respect for his own opinions, but it is stating a self-evident fact to say that no man should consider that he is master of all information on any one given subject. A machinist may be a most excellent workman, and yet there are those who can tell him many things about his work that he never thought of before. An inventor may be very ingenious and have a quite fertile brain, but it is not unlikely that he could find men "within a stone's throw" who could offer him suggestions that would materially aid in perfecting his invention.

It is wonderful how little success will satisfy a man. As soon as certain mechanics are enabled to accomplish a portion of their work with reasonable skill, they at once conceive the erroneous idea that they have nothing more to learn, and assume by this very attitude that they are masters of their art. Upon observing such workmen we are forcibly impressed with the belief that "a little learning is a dangerous thing."

But if egotism is deleterious in the workman, how much more is it so in the manager of an establishment! If the workman is old fogyish he need not necessarily impart his antiquated notions to his colaborers, but if the head of the establishment is such, the whole institution will be more or less influenced by his peculiarities.

The machine shop is a bad place for a man possessing an inordinate bump of self-esteem. He, like the bull in the china shop, is likely to do a great deal of harm. A machinist, above all others, should be a man of enterprise and of broad comprehension. He should be a many-sided man, with a keen observation, and a power to grasp new ideas and make them valuable to himself. But when the machinist is a man of one idea, he is likely to stand in his own light and to bar the progress of others who depend upon his judgment. An inventor once went to a machinist for assistance in perfecting a new mechanical device. As is generally the case in such an undertaking, grave difficulties were encountered. The inventor, at the time when they were attempting to overcome an important obstacle, suggested a somewhat novel way out of their trouble. The machinist opposed this course strenuously, because it was one which he had been taught was erroneous. He would not listen to reason, and by his persistence caused the inventor to follow his plans, to the former's loss. After experimenting for a long while, the machinist was at last forced by sheer necessity to adopt the inventor's suggestions. Had he been willing to give the hints named a fair investigation, he would have saved the inventor anxiety, labor, and money.

The president of a large manufacturing establishment was showing the same to some visitors, one of whom suggested to him in a spirit of kindness that the design of a part of the plant which was then in process of erection might be improved in a material particular. This suggestion was haughtily rejected with the curt saying that he thought the men in charge knew what they were about. This might be so, but as the suggestion was an important, if not vital, one, the part of prudence would have been to have looked into the matter to see whether a mistake was not actually being made, the party making the criticism being an expert in the business. The manufacturer, it is claimed, by his stubbornness failed to avail himself of a suggestion that would save his company many thousands annually. His self-reliance in that instance cost some one dearly.

One should be willing to receive instructions from any reliable source. The adage, "We are never too old to learn," is a good one. In this era of progress, when old theories are daily being shattered, and new ideas enthroned in their place, the man is indeed blind who says that there is none capable of teaching him. Such are not the real master spirits of the age. They are the fossils, who only seemingly live. Really progressive minds are as different from them as day from night.—*The Industrial World.*

Increased Duration of Life.

The stage to which we have at present attained may be stated thus: Compared with the period 1838–1854 (the earliest for which there are trustworthy records) the average of a man's life is now 41·9 years instead of 39 9, and of a woman's 45·3 instead of 41 9 years, an addition of 8 per cent to the female life and 5 per cent to the male. Of each thousand males born at the present day, 44 more will attain the age of 35 than used to be the case previous to 1871. For the whole of life the estimate now is, that of 1,000 persons (one-half males and one-half females) 35 survive at the age of forty-five, 26 at fifty-five, 9 at sixty-five, 3 at seventy-five, and 1 at eighty-five. To put the case in another way, every thousand persons born since 1870 will live about 2,700 years longer than before. In other words, the life of a thousand persons is now equal in duration to that of 1,070 persons previously; and 1,000 births will now keep up the growth of our population as well as 1,070 births used to do. This is equivalent in result to an increase of our population, and in the best form, viz., not by more births but by fewer deaths, which means fewer maladies and better health. What is more, nearly 70 per cent of this increase of life takes place (or is lived) in the "useful period"—namely, between the ages of twenty and sixty. Thus of the 2,700 additional years lived by each thousand of our population, 70 per cent, or 1,890 years, will be a direct addition to the working power of our people.

It is to be remembered that there might be a great addition to the births in a country with little addition to the national working power—nay, with an actual reduction of the national wealth and prosperity—seeing that, regarded as "economic agents," children are simply a source of expense, and so also are a majority of the elderly who have passed the age of threescore. On the other hand, as already said, only one-quarter of the longer or additional life now enjoyed by our people is passed in the useless periods of childhood and old age, and more than one-third of it is lived at ages when life is in its highest vigor, and most productive alike of wealth and enjoyment.—*Cornhill Magazine.*

THE HARDEN HAND GRENADE FIRE EXTINGUISHER.

In our issue of July 12 we referred to this hand grenade, and gave an account of an exhibition showing its practical efficiency, witnessed by a representative of the SCIENTIFIC AMERICAN. It is at once so simple, cheap, and effective, particularly in the incipiency of a conflagration, that it can hardly be wondered at that it has been imitated by others, and this has caused the company to adopt a patented form of package, besides their former patents on the liquid and solid salts which furnish the fire extinguishing properties.

This new form is represented in the accompanying engraving, showing a bottle with a star in medalion form. The manner in which it is used is, as has been before stated, to simply break the grenade, generally throwing it by hand, "in such manner that the contents will be liberated into the flames." One or more of them may also be hung up around

THE HARDEN HAND GRENADE FIRE EXTINGUISHER.

workshops, factories, or offices in places where any danger of fire may be apprehended, as it takes very little direct heat of the flame upon them to explode the bottles and liberate the fire-extinguishing gases. All managers of fire departments lay great stress upon the importance of checking a conflagration in its incipient stages, and a liberal use of these stationary grenades through buildings generally would undoubtedly prove most efficient in this direction, while those thrown by hand are far more efficient and easily available than any number of buckets of water would be.

In accordance with an order from the Navy Department, Chief Engineer Isherwood made tests of this grenade and reported thereon with great detail in most emphatic commendation of its excellent qualities. He says:

"The department may have entire confidence in the ability of these grenades to extinguish flame and in very large masses, incipient fires, that is to say, fires just commencing, in which the mass of flame is not great and with not much solid combustible in ignition can be extinguished almost instantaneously and with very little material. For the protection of valuable papers and other combustible matter in fireproof buildings, I am of opinion that every room should be supplied with these grenades, and that a proper number should be kept conveniently in the corridors ready for instant use by the watchman. There is no doubt the mixture within the bottles will retain its efficiency undiminished during an indefinite period. The carbonic dioxide and ammoniacal gases developed from the liquid by heat are the best that modern chemistry can furnish for the extinction of flame."

The New England Fire Insurance Exchange, of Boston, and the Insurance Exchange of Providence, R. I., have practically examined the working of this grenade and highly recommended its general adoption, as have also the officers of a large number of the fire insurance companies of New York and other leading cities.

Combustion of Explosive Gas Mixtures.

Experiments in regard to the flashing temperature of explosive gases, and the velocity with which the flame is transmitted, have been made by Mallard and Le Chatelier.

1. The flashing temperature of explosive gases composed of hydrogen and oxygen being at 550° C., carbonic oxide and oxygen at 655° C., and that of marsh gas and oxygen at 650° C., on adding of a large volume of indifferent gases to a volume of marsh gas and oxygen, the flashing point becomes but slightly altered, while addition of an equal volume of carbonic acid to a mixture of carbonic oxide and oxygen raises the flashing temperature from 655° to 700° C. Marsh gas and air or oxygen intermixed with a neutral gas can be heated for ten seconds at a temperature above the flashing point; the retardation of the ignition increases with the amount of indifferent gas added, and is a maximum at temperatures little above the flashing point.

2. The velocity with which the flame is transmitted depends upon various conditions, the ignition is either conducted from one stratum to one above and below, transmission by contact, or is propagated by means of high pressure, transmission by an explosive wave.

This latter conduction of the flame has been investigated by Berthelot and Nieille. The two transmissions correspond to the combustion and explosion of liquid and solid explosives like nitro-glycerine and dynamite. Intermediate between both are numerous other modes of transmitting the flame, which depend on accessory conditions and unknown influences. The velocity of transmission by contact probably never exceeds 20 m. per second, which has been verified by numerous experiments. The maximal conducting power of a mixture composed of 40 per cent hydrogen and oxygen, the equivalent quantity of hydrogen being 30 per cent, is equal to 4 3 m. per second, a mixture of marsh gas and air transmits the flame with a velocity of 0·6 m.; illuminating gas and air with such of 1 25 m., and the gaseous explosive of carbonic oxide and oxygen with a velocity of 2 m. per second. The quantity of oxygen employed in these measurements has been less than its chemical equivalent, and the product of combustion was thus intermixed with a portion of the inflammable gas. The conducting power increases with the initial temperature, and depends upon the width of the tube; by using narrow tubes in the examination of explosive gases with great conducting power, the transmission of the flame is accompanied by irregular oscillations and, when these oscillations follow each other very rapidly, cause diminution and finally extinction of the flame. It is at first communicated with uniform velocity, and assumes after some time, which depends upon the conductive power of the explosive gases, a vibratory motion, the report of the flame becomes louder before and after each vibratory period, and, traversing gases of high conducting power, is extinguished before it has reached the final vibratory period.

When the transmitted pressure caused by vibratory motion and extension of the burned gas is equal to that produced by heating the explosive gases to the flashing temperature, the combustion is propagated with a velocity of the compressed wave, we have then a transmission of a flame by an explosive wave.

The Influence of Magnetism on the Development of the Embryo.

Prof. Carlo Maggiorani has recently read an account of some experiments on this subject before the Academia dei Lincei.

During the process of artificial incubation the author exposed a number of eggs to the influence of powerful magnets. A similar set of eggs, being hatched in the same manner, but kept away from all magnetic action, served as a check. Cases of arrested development were four times more numerous in the first group than in the second. Analogous facts had been previously published in the *Natura* (Florence, 1878). Microscopic examination showed that the sterilization of these germs was probably due to an intense vascularization of the yolk sac.

After the birth of the chickens this increased mortality continued, deaths being three times more numerous in the magnetized group. All the counter test chickens reached their full development, while of the 114 of the first group 60 presented notable imperfections. Their movements were also abnormal. There were three cases of paralysis and two of contractions.

Six of these chickens arrived at maturity. Of these, two were cocks of a splendid stature, and endowed with an insatiable reproductive appetite. With the four pullets it was quite the contrary. One of them never laid at all, and the three others generally produced merely minute eggs (the heaviest weighing only 30 grms.), without yolks, without germinal spot, and, in a word, sterile.

The magnetic influence upon the embryo is therefore evident, and its action upon the structure and the functions of the germ is still manifest when the latter is arrived at maturity.

May we not, to explain this effect of the magnets, suppose an interference between the magnetic vibrations and the heat vibrations which animate the molecules of the fecundated germ, and impel them toward a new condition of organic equilibrium? This influence generally prevents, and more rarely retards, the development of the embryos (hypertrophy in the two cocks, and atrophy in the four hens), and, as interference implies analogy, may we not infer that the vibrations which impel the germ toward its development are analogous to the magnetic vibrations?—*Jour. of Science.*

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ENGINEERING INVENTIONS.

A coal washing machine has been patented by Mr. Samuel Nevins, of Summit Hill, Pa. It comprises an automatic shaking screen, water circulating apparatus, endless coal rake, and endless slate elevator in a water tank for separating slate, fine dust, etc., from coal, and for washing the coal.

A well drilling machine has been patented by Mr. Lycurgus Nelson, of Florence, Tenn. It consists of a specially devised frame, mounted on low wheels for convenience of transportation, with a rock drill in combination with a driving shaft, walking beam, and sheave, with several special features to promote economy and efficiency.

MECHANICAL INVENTIONS.

A pulley has been patented by Mr. John D. H. Clearland, of Smithfield, Minn. It has dovetail or locking recesses in which are wooden keys to facilitate the securing of leather or other material on or around the pulley by nailing it to the keys, thus making a metal pulley covered on its periphery.

A motor has been patented by Mr. Cesar Huet, of New Orleans, La. It consists of a novel contrivance for multiplying and transmitting the motion, an improvement in the contrivance of open coupling for applying power to a fan and other devices, with an improved regulator and brake device.

A sand belt attachment for spoke lathes has been patented by Mr. Ephraim Case, of Owensborough, Ky. The sand belts are contrived with the cutter head carriage, for following the cutter heads along the spokes to smooth them automatically after the spokes, and thus save the time and labor of subsequently smoothing them separately.

AGRICULTURAL INVENTIONS.

A stubble cutter has been patented by Mr. Joseph P. Gueno, of Terre Bonne Parish, La. In combination with specially devised side bars, and knives attached thereto, is a chisel edged tooth and colter, so that as the implement is drawn forward the colters cut and break the roots of the stalks, the knives cutting such as may be left standing.

MISCELLANEOUS INVENTIONS.

A draught vehicle has been patented by Mr. Thomas Hill, of Jersey City, N. J. The mud shields are attached to the boxes containing the springs by which the vehicle body is supported, and arranged to overhang and partly inclose the inner end portions of the arms or journals of the axle.

A buggy spring has been patented by Mr. Carlos J. Miller, of Mount Kisco, N. Y. The invention consists in a special construction of spring adapted for buckboard buggies, causing the vehicle to ride easily and prevent rumbling noises, and also preventing the buckboard from sagging in the middle.

A wick trimmer has been patented by Mr. Robert Hoffman, of Cohoes, N. Y. In combination with a pair of shears is a clamp for pressing the wick against one of the blades, and a lever for acting on the clamp to press its inner edge piece from the edge of the blade to permit passing the wick in between the edge of the blade and the clamp.

A calcimining and wall brush has been patented by Mr. Henry Bintz, of New York city. The object of the invention is to facilitate the manufacture and promote convenience in renewing the bristles, the handle and its body portion for holding the brush head being struck up in halves from sheet metal, the brush head being removable.

A folding table has been patented by Mr. Charles M. Bolles, of Dallas, Texas. When folded the table is triangular in shape, so it can be placed in the corner of a room, but will make a square or parallelogram of much larger size when unfolded and set up in the room, by the use of the leaves and specially devised braces.

A calendar attachment for pens and pencils has been patented by Mr. Schuyler C. Lord, of East Surry, Me. This invention consists in a tube with a rotating sleeve, the whole made for fitting on the end of a pencil or a penholder for use as a calendar, the days of the week being placed on one tube and of the month on another, so the sleeve can be set for any month.

A log turner has been patented by Mr. Royal E. Park, of Sherman, N. Y. It is for turning logs upon their carriages in saw mills, and the weight of the log causes the device to automatically turn the log upon the carriage and force it to proper position, the device being also simple and strong and not liable to get out of order.

A vacuum pan has been patented by Messrs. James D. Edwards and Leon F. Haubtman, of New Orleans, La. This is primarily for use in the sugar manufacture, and practically embraces a system including two pans acting together, a condenser, receivers, tanks, pumps, steam connections, all making a complete practical plant, with many novel features in construction and mode of operating.

A wagon end gate has been patented by Messrs. George Thomas and Harrison H. Thomas, of Waterloo, N. Y. End wings or gates are secured to the gate and have notches and stops, while rods are held on the sides of the box with a hook lug and handle at their opposite ends, so the end gate can be locked in position when raised, lowered, or held at an inclination.

A graining compound has been patented by Messrs. Hezekiah Bailey and William H. Bailey, of St. Thomas, Ontario, Canada. It consists of a mixture, compounded in a special manner, of apple cider, eggs, saltpeter, and color, which flows easily from a sponge or brush, and may be worked with coarse or fine combs, the fingers, rags, etc., as paint is worked in graining.

A sheet metal roofing plate has been patented by Mr. Patrick H. Regan, of Nashville, Tenn. The joints are made to easily lock together and be waterproof, while not liable to be broken or split by pressure or tension, and also providing for contraction and expansion from changes of temperature, the face of the plate is also made to deflect water away from the joints.

A crane has been patented by Mr. John Wild, of Chester, Pa. This invention covers a special construction, combination, and arrangement of parts to improve the efficiency of that class of cranes where the hoisting block has to travel along the crane beam for shifting the load, and has a novel clutch mechanism with pulleys for moving the hoisting block backward and forward.

A sash holder has been patented by Mr. Obadiah G. Newton, of Trenton, Mo. It is a special combination of an eccentric with an attached handle and a pendent friction shoe, both secured on or to the shoe, making a very simple and efficient fastener, which may be applied either to the right or left hand side, and is thin enough to allow one sash to freely pass another.

A macerating machine has been patented by Mr. Frank M. Avery, of Brooklyn, N. Y. It is a grinding or crushing machine, with a revolving drum and concave, more especially intended for obtaining the fibers and juices from vegetable substances, adapted to be easily and quickly adjusted for different materials, and calculated to yield to avoid breakage when hard foreign substances enter the machine.

A box for changing photographic plates has been patented by Mr. Hieronimus Mader, of Isny, Wurtemberg, Germany. The object of the invention is to provide an improved device for facilitating the exchanging of dry plates within or outside of the studio, without necessitating the use of complicated appliances, such as portable dark rooms, etc., and this device enables a photographer to easily carry a large number of plates with him.

The preparation of caseine and of articles made therefrom forms the subject of two patents issued to Mr. Emery E. Childs, of Brooklyn, N. Y. The first patent provides for the production of a cheap and superior quality of caseine from milk curd direct or common cheese, the products to be used for various useful and ornamental articles, while by the other patent the milk curd is taken after it has been separated from the whey, but before the water has been pressed out, and working or kneading such naturally saturated curd in its own water; the coloring ingredients may be introduced here, the whole worked at a temperature below boiling, and, as a tough, glutinous mass, pressed into sheets or moulds of any desired form.

NEW BOOKS AND PUBLICATIONS.

POULTRY FOR PROFIT.

This is a neatly printed little volume, by P. H. Jacobs, editor of the *Poultry Keeper*, and *Farm, Field, and Fireside*, at which office it is published in Chicago, Ill. The book is intended for beginners in poultry raising; the author claims to have had a practical experience of thirty years in the poultry yard.

THE ELECTRICIAN'S POCKET BOOK. Cassell & Co., 739 Broadway, New York.

This is an English edition of Hospitalier's Formulaire Pratique de l'Electricien, translated by a member of the Society of Telegraphic Engineers and Electricians, London. The work will be found useful for electricians in all branches of their art. It contains illustrations of the ordinary appliances used in telegraphing, in house alarms, office signals, etc., with tables giving the conductivity of the various metals, directions for charging the batteries, etc.

VENTILATION AND HEATING. By John S. Billings, Surgeon U. S. Army. *The Sanitary Engineer*, New York. Price $3.

This work is a revised and enlarged publication in book form of a series of papers formerly published in the *Sanitary Engineer*, and treats of the principles involved, under the conditions of modern life, and their practical application. The source from which this book emanates is of such established high character that commendation would be superfluous.

AN IMPORTANT QUESTION IN METROLOGY. By Charles A. L. Totten. John Wiley & Sons, New York.

This book is a "challenge to the metric system," and an "earnest word with the English speaking peoples on their ancient weights and measures," dating their origin back to the builders of the Pyramids and treating them as a product of the knowledge originally imparted to the Hebrews, according to Bible accounts.

FORESTRY OF NORWAY, NORTHERN ASIA, AND THE URAL MOUNTAINS. By John Croumbie Brown, LL.D. Oliver & Boyd, Edinburgh.

The title above given covers three distinct volumes by the same author, who is also the author of nine other books on forests and forestry, and arboriculture. The author has had long experience as a practical botanist and lecturer on botany, and his books contain much valuable information on a subject that is of very general interest in this country at the present time.

Lee's Map of the Industries of Western Pennsylvania is a convenient office chart of the Pittsburg Gas Coal Beds and the Connellsville Coke Field, with their transportation lines and index to the most important industries.

Received.

THE MARITIME CANAL OF SUEZ. FROM ITS INAUGURATION, Nov 17. 1869 to 1884. By Professor J. E. Nourse, U S N. Washington, D. C.: Government Printing Office.

A NEW SYSTEM OF LAYING OUT RAILWAY TURNOUTS. By Jacob M. Clark. D. Van Nostrand, New York.

A NEW METHOD OF RECORDING THE MOTIONS OF THE SOFT PALATE. By Harrison Allen, M.D. P. Blakiston, Son & Co., Philadelphia.

Special.

SPITTING, AND THE MEN WHO SPIT.

The habit of spitting is a peculiarly American one, and it is growing on the American public. When Charles Dickens first visited this country, he said some sarcastic things about it, which gave considerable offense, because they were justly merited. Since then the habit has increased a thousandfold. Why do people spit so much? Is it mere habit, or is there a valid cause for it? It is at best a very unpleasant and untidy habit. With some the habit is from another cause, which is quite as objectionable, namely, the chewing of tobacco, which demoralizes the salivary apparatus as badly as it defiles pavements and carpets. With that habit, however, we having nothing to do just now, for we are about to refer to a far more deeply-seated cause of the evil practice.

The fact is that a very large proportion of the American people have catarrh. Catarrh is a disease of many forms. Its seat is chiefly in processes above and in the immediate rear of the nose. The delicate passages are lined with an exceedingly sensitive membrane, which is often either lightly or severely inflamed. When inflamed it secretes a peculiar liquid or semi-liquid deposit, which must be got rid of in some way. It must either be absorbed, swallowed, or spit out. The causes which produce it prevent its absorption. To swallow it is to afflict the stomach with that which is not only indigestible, but also poisonous. To spit it out seems the only way to get rid of it. And so along the street and in public conveyances and in halls, churches, theaters, stores, and even elegant private apartments we hear and see the constant hawk, hawk, hawk, spit, spit, spit, of thousands of people who would like to be free from the unclean habit, but who cannot, because they have catarrh.

Our editor had occasion recently to hold conversation with a gentleman who was formerly in bondage to this habit by reason of grievous catarrh, but who has of late years been thoroughly emancipated from it. He is a gentleman of culture and education: Mr. Chas. E. Cady, at the head of Cady's Business College, at Fourteenth Street and University Place, New York. In view of his position and the influence he holds over young men, his experience is worth quoting.

Mr. Cady's catarrh was of long standing; probably inherited. He remarked to our correspondent that in his early life he had a few hobbies on the health question; such, for instance, as that he should bathe freely in very cold water all winter, and that he should sleep with more cold air in his room than most people consider good for them. As he lived in Ogdensburg, N. Y., he had all the facilities he wanted for making the most of cold air and cold water in wintry weather.

"By the time I was twenty years old," said Mr. Cady, "I had catarrh, deep seated and firmly fixed. It came on so slowly that I hardly knew it was catarrh. I had to use my handkerchief constantly. I was continually hawking and spitting. The habit grew upon me. It became a great nuisance to myself, as I know it was to other people. There was a constant dripping into my throat. I always had a weak stomach, and this made it weaker. I was not prostrated, nor was I such a dyspeptic that I could not eat my food; *but I was in slavery to this horrible catarrh, and I saw no way of escape from it.*

"After trying sundry catarrh remedies without advantage, I concluded to make an experiment with Compound Oxygen, for which purpose I consulted Dr. Turner, at the New York office of Drs. Starkey and Palen. I procured a Home Treatment: *In about four weeks great improvement was visible. I continued the treatment for nearly six months at intervals; my catarrh, which had been unusually obstinate, was now at an end. The unpleasant secretions disappeared*, and also the pain in my head which had accompanied them. The necessity for hawking and spitting ceased, *and I was free from that unpleasant bondage.* My stomach grew stronger and my digestion better, and so continue to the present time.

"*This was about three years ago. Since then I have had no return of the catarrh, and I have not needed any more Compound Oxygen.* I know my cure must be reasonably permanent, for I have taken several slight colds, which have passed away without leaving any evil effects. During my catarrhal days such colds would have aggravated my disease to a serious extent, and caused me much annoyance.

"With my catarrh gone and my general health greatly improved, you may quote me as freely as you please as a firm believer in the virtues of Compound Oxygen.

"I wish for the sake of the thousands who are kept by their catarrh constantly hawking and spitting, that all victims of this unpleasant disease could know of Compound Oxygen and make trial of it. I see no reason why it should not do for them what it has so thoroughly done for me."

A "*Treatise on Compound Oxygen*," containing a history of the discovery and mode of action of this remarkable curative agent, and a large record of surprising cures in Consumption, Catarrh, Neuralgia, Bronchitis, Asthma, etc., and a wide range of diseases, will be *sent free*. Address DRS. STARKEY & PALEN, 1109 and 1111 Girard St., Philadelphia.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Valuable Patent.—United States Patent allowed. Absolutely perfect and exceedingly simple railroad nut lock. I will sell two-thirds of each foreign patent for the money to pay for the patent. Address James A. Campbell, care "Banner," Brenham, Texas.

Wanted.—A competent man as Foreman of Boiler Shop. Must have best of references. Phœnix Foundry and Machine Co., Syracuse, N. Y.

Wanted.—Responsible parties to manufacture the Fretel Locomotive. Address Gabriel Fretel, Porto Real, Province de Rio Janeiro, Brazil.

Practical Instruction in Steam Engineering, and situations furnished. Send for pamphlets. National Institute, 70 and 72 West 23d St., N. Y.

The Cyclone Steam Flue Cleaner on 30 days' trial to reliable parties. Crescent Mfg. Co., Cleveland, O.

For Steam and Power Pumping Machinery of Single and Duplex Pattern, embracing boiler feed, fire and low pressure pumps, independent condensing outfits, vacuum, hydraulic, artesian, and deep well pumps, air compressors, address Geo. F. Blake Mfg. Co., 44 Washington St., Boston; 97 Liberty St., N Y. Send for Catalogue.

Quinu's device for stopping leaks in boiler tubes. Address S. M. Co., South Newmarket, N. H.

Mills, Engines, and Boilers for all purposes and of every description. Send for circulars. Newell Universal Mill Co., 10 Barclay Street, N. Y.

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"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 86 John St., New York.

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Steam Boilers, Rotary Bleachers, Wrought Iron Turn Tables, Plate Iron Work. Tippett & Wood, Easton, Pa.

Send for Monthly Machinery List
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121 Chambers and 103 Reade Streets, New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent agency, 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Curtis Pressure Regulator and Steam Trap. See p. 286.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 286.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 270.

Drop Forgings. Billings & Spencer Co., Hartford, Conn.

Brass & Copper in sheets, wire & blanks. See ad. p. 222.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Hoisting Engines. D. Frisbie & Co., Philadelphia, Pa.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 222.

Pays well on small investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday-schools, and home amusement. 136 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

Renshaw's Ratchet Drills. No. 1, $10; No. 3, $15. Cash with order. Pratt & Whitney Co., Hartford, Conn.

Shipman Steam Engines.—Small power practical engines burning kerosene. Shipman Engine Co., Boston. See page 317.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) A. G. H. desires to know the process used for deodorizing tallow in the manufacture of imitation butter. A. It is hard to say just what process is used by those who manufacture artificial butter. Admission to the factories is almost impossible, and the details of manipulation are kept very secret. A good article of tallow is generally used, and it is presumed that steam is injected into the fat in such a way as to remove the odor and color. See article on this subject on page 6333 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 397. On a small scale, substances rich in oxygen can be used to purify the tallow, thus, by melting the fat and adding to it a small quantity of potassium bichromate dissolved in water; and subsequently a little hydrochloric acid. The mixture is then stirred, and washed with warm water until thoroughly cleansed, when the tallow will be found to be completely deodorized and bleached. Potassium permanganate is likewise used with good results.

(2) S. R. S. asks in what year Kolbe discovered the process of making salicylic acid from carbolic, the price of salicylic acid before the discovery, and what amount of the salicylic acid could be obtained? A. That salicylic acid may be obtained from phenol was demonstrated by Kolbe and Lautermann in 1860. In 1874, Kolbe modified and simplified his original process, subsequent to which it became prominent as a disinfectant. Prior to 1874 it had no commercial value, and of course could not be obtained in quantity.

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(3) A. C. G. asks for a rubber stamp indelible ink for marking clothing, it being necessary that glycerin be used in its manufacture to keep the pads from drying up quick, and the ink from clogging up the letters. A. The following is an indelible stamping ink, and probably will be suitable for your wants: Eosine 1 part, aniline black 4 parts, aniline blue 2 parts, cupric chloride 1 part, ammonium chloride 3 parts, sodium chloride 2 parts, glycerine, lampblack, water, and oil in sufficient quantity to bring the ink to a proper consistency for the use to which it is intended. The ingredients are thoroughly incorporated by grinding or stirring, when the composition is ready for use. To prevent moulding a small proportion of salicylic acid may be added.

(4) H. D. S. asks a receipt for making some kind of cement that will stick greasy leather. The trouble is the oil comes out of the leather and mixes with the rubber cement. A. Try the following: Soak equal parts common glue and isinglass for ten hours in just enough water to cover them. Bring gradually to a boiling heat, and add pure tannin until the whole becomes ropy, or appears like the white of eggs. Buff off the surfaces to be joined, apply the cement warm, and clamp firmly.

(5) F. H. asks for the process of making whiting and plaster of Paris. A. Whiting is simply chalk, ground, elutriated, balled, and dried. Grinding mills break up the chalk and mix it with water, which is constantly flowing in. On leaving the mills, the mixture passes along a series of wooden troughs, where the sand, which has a greater specific gravity than the chalk, is deposited, the chalk passing on into the settling pits. On being taken from the pits, the whiting is partially dried on a floor under which hot flues run; then cut up into large rough lumps, and placed in racks on cars which run on tramways into an immense oven. The heat from the flues is greatly increased by an air-blast, which also carries off the moist exhalations from the drying whiting; 12 hours on the heated floor and 12 in the oven thoroughly dries the whiting, and it is ready for packing. Plaster of Paris is gypsum (sulphate of lime) carefully burnt, so that it loses its water of crystallization.

(6) J. P. O'B. writes: I intend to build a line of telephone like that described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 142, and would like to have you give me a little more information upon it. 1. Would a person be liable to prosecution if he built such a line, and is it an infringement upon the Bell or other patents? A. The Bell Telephone Company claim to own patents covering all articulating telephones. 2. How far will such a line work satisfactorily? A. Such a line as you refer to will work over a line three or four miles long. 3. Do you have to use magnet bells for a signal? A. You may use magnet bells or a battery call. 4. Would smaller wire than No. 14 do just as well? A. No. 12 iron wire is what is commonly used for this purpose. A smaller wire offers a greater resistance, and does not answer the purpose as well. 5. Of what are the ground connections (what metal), and how large pieces? A. You can ground your line on water pipes or on iron drain pipes, or by connecting your wires with copper plates, having about ten square feet area, and located in earth that is constantly moist.

(7) G. G. asks (1) where he can get a work describing how to make a powerful magnet (not a permanent one). A. Prescott's Telephone, Electric Light, and Other Novelties contains a large number of illustrations of magnets of different forms. You will also find in SUPPLEMENT, No. 182, a description of a large variety of forms of electro-magnets. 2. The best kind of battery to work it with? A. The best battery for securing the greatest amount of power in a large electro-magnet for a short time, is the plunging bichromate battery. 3. What magnet and battery would exert a force equal to lifting ten pounds through a space of five inches? A. To lift ten pounds a space of five inches you will need an axial magnet. A magnet formed of about 200 turns of No. 12 cotton covered wire used in connection with 10 cells of the battery described, having plates about 4 by 8 inches, will probably answer your purpose.

(8) S. P. S. writes: 1. Can you advise me of a good varnish or polish for a flute? One that will be comparatively unaffected by perspiration, and that can be bought already made up. A. Those who make flutes use simply a mixture of beeswax and linseed oil. This suitably applied (and there lies the secret) will produce the most satisfactory kind of a finish. 2. Also can you advise a lasting preparation for silver-washing the keys of a flute? A. Nothing will be as lasting as silver or nickel plating. 3. Recently I have noticed the mercury in a barometer, after assuming a convex form preparatory to rising, throb slightly. Does this denote presence of air? A. We do not think that the action described is due to the presence of air.

(9) B. M.—Plumbago is largely used as a lubricant, both in its dry pure state and pulverized and mixed with tallows and oils. It is used dry on wood for the slides in organs and other movements requiring freedom from oil. It is largely in use combined with tallow and oil as axle grease. Also compounded with cotton as piston packing for engines and pumps and for valves. It is a compound in several patent journal boxes. With tallow or lard it is excellent for all bicycle bearings, as not apt to spread, but not so easily applied as oil.

(10) H. H. writes: I have an electric pen, also a parlor phonograph. I have broken one of my porous cups; is there any way to mend it, and how? A If your porous cup is only cracked, you may stop the leak by allowing it to become perfectly dry and filling the crack with melted paraffine. If it is broken so that the parts are separated, you may repair it by using a cement composed of equal parts of Peet's gutta percha and shellac melted together. 2. Where can I procure the light linen paper for copying? I have tried several kinds, but they are not satisfactory. A. Any of our stationers can furnish the paper you require.

(11) L. P. asks how the rhubarb is prepared that is sold in England as preserved ginger? A. The article is not on the American market. Marion Harland, who is an excellent authority, gives the following receipt for preserving ginger. She says: "Pare the roots of green ginger, and lay in cold water fifteen minutes. Boil in three waters, changing the hot for cold every time, until very tender; drain, and lay in ice water. For the sirup allow a pound and a quarter of sugar for every pound of ginger, and a cupful of water for each pound of sugar. Boil and skim until the scum ceases to rise. When the sirup is cold, wipe the ginger dry and drop it in. Let it stand twenty-four hours. Drain off and reheat the sirup. This time put the ginger in when blood warm. Do not look at it again for two days. Then reboil the sirup, and pour over the ginger scalding hot. In a week drain off once, boil, and add again while hot to the ginger; cover closely. It will be fit for use in a fortnight. The rhubarb lozenges are made with four pounds of sugar and ten ounces best Turkey rhubarb in powder with a little gum solution, say 1 ounce dissolved gum arabic to 12 ounces of sugar.

(12) G. D. C. writes: I have been trying to cast lead figures (or type in one piece) from a plaster of Paris mould, but have failed three times. The mould came off good and clean, and after warming it I poured in lead, then took off after cooling, but the figures were all run together like so many bubbles. What was wrong? A. You cannot cast sharp lead figures or type in a plaster mould; you should use type metal. A common way of making stereotypes is to form the mould as you have done, then dry it perfectly, then dip it, face upward, in melted type metal, allowing it to remain below the metal until all of the steam and gases have escaped, when the mould may be raised out of the melted metal and placed in a level position and allowed to cool.

(13) T. B. B. writes: 1. I have a china tea set decorated with gold bands. Is there any method by which I can remove those gilt bands without injury to the ware? I want to hand paint the set, but cannot do so satisfactorily unless the gilt work is removed. A. Try removing the gold leaf by means of tripoli or rotten stone. 2. How is this gilt decoration put on table ware? A. It is deposited from a gold solution.

(14) W. T. B. writes: 1. I have had the tops or carbon heads of several Leclanche batteries become soft and run out; what causes this and what will remedy it? A. The carbon in the Leclanche battery is cemented in the cell with pitch. 2. What glue can I use to patch a boat with below the water line; patches of canvas? A. Apply the canvas patches to your boat with thick white lead paint, allowing it to become dry before placing the boat in the water.

(15) C. B. D. writes: I have constructed a dynamo five-fourths the size of your drawings in your SUPPLEMENT, No. 161, with the exception that I have made two field magnets instead of one, have wound field magnets with five layers No. 14, and armature with 6 layers No. 16 wire. I run it at 1,600 revolutions per minute. I can get plenty of sparks at the commutator brushes when connected by itself, but when I insert a Maxim 16 candle incandescent lamp in circuit all sparks cease. The lamp is perfect, as I have had it tested. Is the dynamo not powerful enough, or where is my trouble? A. The current produced by your dynamo-electric machine is a quantity current, and incapable of overcoming the resistance of the 16 candle power lamp. Probably the lamp has a resistance of 100 ohms or more, whereas your dynamo would be incapable of working through a resistance of more than 25 or 30 ohms.

(16) C. V. S. asks if a box 1½ feet square and 3 inches high can be heated to 104° Fah. by means of electricity. Can it be done by means of coils? And if so, what kind of a battery would be best, and would it be very expensive? A. You can heat a box of the size given by means of electricity, but it would be a very expensive method of generating heat. The coils should be made of platinum, and you would require a large battery. The size of the battery and the proportion of the coil would be entirely a matter of experiment.

(17) O. G. H. writes: I have a boat 25x5x4 feet, drawing 18 inches of water. Will you kindly inform me what horse power boiler and what size cylinder, also what size screw, pitch and number of blades of same, must I use in this boat to get an average speed of 12 miles an hour? Also please inform me of the dimensions of the boiler. A. Engine 4 inches or 4½ inches diameter and 6 inches stroke. Vertical tubular boiler 34 inches diameter and 50 or 52 inches high, with not less than 120 feet of fire surface. Propeller 30 inches diameter and 42 to 44 inches pitch, 3 blades. It will be very difficult to get a speed of 12 miles per hour from a boat of these dimensions, but you may get 10 miles with boat of good, easy model.

(18) J. D. McR. writes: I have a boat 18 feet keel and 4½ feet beam, which draws 3 inches of water at bow and 18 inches at stern when loaded. I am building for it an engine 2½x2½. The wheel is two bladed, about 17x26; what size boiler would you recommend, and what is the greatest speed that can be had from the boat with the 2½x2½ engine and a boiler of sufficient size, also with any other size engine which you think best suited for this boat? Do you think this boat can be made to run 10 miles per hour? Would you put on a larger wheel with less pitch? Please advise me what is necessary to do to get the greatest speed out of the boat. A. You should have a vertical tubular boiler 24 inches diameter and 42 inches to 46 inches high. The pitch of your propeller should be such as to let the engine run at a high speed, say 350 to 400 revolutions per minute, then with your engine you may get a speed of 7 or 7¼ miles. If you increase the engine to 3 inches diameter and 4 inches stroke, and the boiler and propeller in proportion, you would probably get a speed of 8½ miles per hour.

(19) C. B. L. asks how he can learn to be an electrical engineer or electrician. A. You can study electrical engineering at some of our technical schools, the Stevens Institute of Technology at Hoboken, N. J., Cornell University at Ithaca, N. Y., the Rensselaer Polytechnic School at Troy, N. Y., or the Worcester Polytechnic School at Worcester, Mass., or by purchasing the necessary books you can pursue the study alone. If you desire to make it a profession, we advise you to first become an adept in mechanical engineering, afterward take a course in electrical engineering, and then apprentice yourself to some manufacturing electrician or electrical engineer. 2. Is there any difference between an electrical engineer and an electrician? A. An electrical engineer is supposed to combine the qualities of a mechanical engineer and an electrician, whereas an electrician simply deals with the theoretical part of the business.

(20) F. E. W. writes: 1. Please inform me, to settle a dispute between myself and a school superintendent, whether Robert Fulton's steamboat was the first steamboat in actual use. Did not John Fitch of Pennsylvania have a steamboat that worked on the Delaware River in 1790? A. M. Perrier navigated a small steamboat on the Seine in France in 1775. Jouffroy built and ran a small steamboat on the Soane in France in 1781. James Rumsey exhibited an experimental steamboat 80 feet long, on the Potomac in 1782. In 1788 John Fitch launched at Philadelphia his steam paddle boat, making a passage to Burlington, 20 miles, where she unfortunately burst her boiler, from whence she floated back to the city, and being repaired made several trips. About this date Symington, Oliver Evans, and others built experimental steamboats. In 1793 Fitch exhibited his propeller, a boat about 15 feet long, on the "Collect" pond in New York Robert Fulton built an experimental steamboat that ran on the Seine, in France, in 1803, and soon after ordered the engine for the Clermont, of Boulton & Watt, in England. In 1804 John Stevens built a small steam propeller that made excursions on the waters around New York; but no practical results were reached until Robert Fulton started the Clermont in August, 1807, running as a regular passenger boat to Albany. Soon after, in 1807, John Stevens finished the Phœnix, but was prevented from running upon the Hudson by a legislative grant to Fulton. The Phœnix was run a short time upon the New York and New Brunswick route, and in 1808 went to Philadelphia by sea, being the first steamer sailing upon the ocean. Thus, while Fitch and Fulton were not the first to build or run a steamboat by name, the practical triumph of steam navigation belongs to Robert Fulton and John Stevens.

(21) J. H. writes: I am a student of Lehigh University and am taking the course in civil engineering. Having a well equipped library at hand, and determining to learn all I can of mineralogy, I wish you would let me know what books pertaining to that subject I shall read, and in what order I shall read them. A. Obtain the latest edition of Dana's Mineralogy, as a descriptive text-book. Begin at once to gather specimens, and learn to recognize them by their descriptions in the book. A visit to cabinets of named minerals will greatly aid you. It would also be very profitable to visit the Museum of Natural History in Philadelphia or in New York. The study of geology will largely increase your interest in nature's methods and the localization of minerals.

(22) F. P. asks: Is it necessary that poultry running at large upon the farm should have oyster shells or bones, or both? Why are they fed to poultry? Should they be burned or fed raw? A. Anything that will furnish phosphorus and lime to the poultry will answer. If you provide them with oyster shells, they should be burned to form lime.

(23) S. McI. asks: Which is the greatest power, and what are the proportions of water or steam, the pressure on each volume being the same, in a water wheel and steam engine? A. Steam will yield the greatest power, on account of its expansive force, its slight inertia, and the rapidity with which it may be passed through the engine.

(24) W. asks what the general mode of testing glue is; how to find out by testing in cups how much water different glues will take, so as to determine their relative value. A. We do not know that the value of glue can be best tested by the quantity of water it will absorb, although the best glues will absorb the most water, and will also swell up in cold water without dissolving or becoming slimy. A good test is to try the prepared glue by gluing pieces or blocks of maple together; after drying, break the blocks apart. The best glue will take splinters from the solid wood. Another way, when buying glue, is to decide by the smell, color, and breaking with the hand. Good glue will spring and splinter, while poor glue will break square like glass. Avoid glue that has a burned or fetid smell.

(25) C. P. K. asks how to make camphor ice.

A. Almond oil	1 pound.
Rose water	1 pound.
Paraffine	1 ounce.
Camphor gum	2 ounces.
Otto of rosemary	1 drachm.

Melt the paraffine, and stir in the oil and other ingredients while cooling.

(26) T. B. E. writes: I am suffering greatly with a frostbitten foot. Can you give me a remedy? A. No remedy is known to which it is safe to trust for a permanent cure. Many are advertised, but it is folly to spend money for them. Present relief can be obtained by the use of suitable liniments. One made of:

Tincture of opium (laudanum)	1 ounce.
Tincture of arnica	3 "
Chloroform	½ "
Camphor	½ "
Glycerine	1 "

gives commonly prompt ease, and after a few applications makes a temporary cure. Of course the foot should be guarded as perfectly as possible from exposure.

(27) J. D. McC. asks how and of what ingredients tailor's chalk is made, such as used in marking cloth when cutting out garments. A. The substance used is a variety of talc or steatite (sometimes called soapstone) known as talcose slate. It is a mineral, and is a hydrated silicate of magnesia.

(28) V. B. M.—No cement will make your boiler tight that leaks around the base of the dome. The leaks are no doubt caused by a faulty construction. The shell is possibly cut out too large at the dome junction, which causes a movement of the seam by the great pressure. It should be examined by a competent boiler maker and stayed crosswise, then calked.

(29) J. M. H. asks how to cure a tea kettle from rusting. A. Get the best quality of tin, or make the kettle of tin lined copper.

(30) W. K. M.—Cast iron cannot be practicably hardened. It is not reliable. Malleable iron can be casehardened in the usual way.

(31) J. A. H. asks how to proportion plumber's solder for wiping joints in lead pipe. A. Tin 1 pound, lead 2 pounds; melt together and cast in bars.

(32) T. & M.—White japanning upon cast iron is done in the same manner as for colors. The articles are cleaned free from grease and sand, or smoothed in any mechanical manner. The first coat is laid on with a brush quite thin (with turpentine), then baked in an oven at 250° until dry. Then a second coat thicker than the first, or as thick as it can be spread, if you wish to finish with two coats; bake as before. If the surface is not as smooth as desirable, the first coat can be smoothed down with sand paper after baking, and a second and third coat applied. The white japan varnish can be obtained from any of our varnish makers.

(33) A. S. R. asks what are automatic momentum breakers as before mentioned in the SCIENTIFIC AMERICAN. A. Any stone breaker with a heavy fly wheel that by its momentum carries the breaking jaws over the hardest part of their work, recovering its power during the back motion of the jaws.

(34) O. O. asks the greatest distance a cannon ball or shell has ever been thrown, and when and where. Also what gun? A. About 7 miles, by a gun called the "Swamp Angel," shelling the city of Charleston during the war of the Rebellion.

(35) N. H. writes: I have a small engine 2½x6, for which I wish to make a boiler according to directions in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 182. Would one made of 10 flasks in the fire and 2 for dry steam furnish enough steam for it, and what power would it be? If not, how many would I need? A. With 10 flasks for heating surface and 2 for steam chamber, you might realize a half horse power at 40 pounds pressure.

(36) N. H. asks: Does the center of a shaft turn? A. A theoretical axis or center is supposed not to turn; but all parts of a solid body moving around or upon an interior axis or center turn. The trouble comes from confounding an imaginary line or axis with the material body moving upon it.

(37) E. J. asks for a material or composition which in a soft state is plastic, and can be hand worked like clay into ornamental figures, which when dried becomes hard and strong, without firing. Something not too expensive would be preferable. A. Take the finest plaster of Paris, and sprinkle it into the water, stirring it till the mixture becomes of the consistence of thick cream. Perhaps, however, Portland cement would do, as plaster of Paris hardens so quickly, and you can keep the cement in working condition several hours.

(38) C. F. L. asks: How many feet of one inch pipe would it take to condense the steam from a 3 horse power engine doing ordinary labor? Would coils of pipe put in a common barrel and kept covered with cold water be a good condenser for such an engine? A. A coil of 1 inch pipe of 100 feet in a barrel or trough at medium pressure (40 pounds). If high pressure, 60 to 80 pounds, 150 feet of pipe. If you can make it in two sections, so as to give a larger area to the exhaust, it will do better service.

(39) G. D.—Ink stains can be removed by various reagents, such as a cold aqueous solution or an acetic acid solution of calcium hypochlorite, bleaching powder, or javelle water. Dilute nitric or muriatic acid is sometimes used. The following is from our back files: Take of muriate of tin, 2 parts; water, 4 parts. To be applied with a soft brush, after which the paper must be passed through cold water.

(40) E. B. R. criticises our answer to S. L. W. (40), vol. li., No. 15, on how to make a cheap rheostat, but E. B. R. proceeds upon the supposition that any dealer in wire will "measure off an ohm," and that all wire of the same nominal size is of the same resistance for a given length. We do not think that any dealer would "measure off an ohm" except by the foot rule, and this would be a very rough measurement indeed. But if the dealer were to supply a length of wire measuring exactly 1 ohm, its resistance would be varied by coiling or stretching, and no accurate results could be arrived at. Allowing that an ohm of a certain kind of wire were procurable, an accurate resistance box could be made by comparing the resistance of other lengths of wire with that of the standard; but foot rule measurements in electricity will hardly answer. Our friend has made another mistake in the matter of winding. The spools of a resistance box should be wound in parallel layers, so that the current may pass through the coils in opposite directions and thus neutralize magnetic and inductive effects which in a coil "wound exactly like a sounder magnet" would be the source of much trouble. When only a very rough approximate to a given resistance is required, a box made on our correspondent's plan might do. Our former reply was correct. A standard resistance must be had for comparison. It is not an easy task to make an accurate rheostat.

(41) H. R. C. writes: I have a letter from Abraham Lincoln on which I had the misfortune to drop a large blot of ink. Is there anything I can use, without destroying the glaze, to take it off, as the letter is in splendid condition? A. Ink stains should first be treated with a solution of tin protochloride to deoxidize the iron, and then it can be removed with dilute oxalic acid. An acetic acid solution of calcium hypochlorite is likewise an excellent substance with which to remove the ink. First try it on a piece of paper before attempting to use it on your letter.

(42) T. G. C. asks for a preparation for polishing plate glass and removing slight scratches. A.

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Rub the surface gently first with a clean pad of fine cotton wool, and afterward with a similar pad covered over with cotton velvet which has been charged with fine rouge. The surface will under this treatment acquire a polish of great brilliancy, quite free from any scratches.

(43) S. W. F.—The best that can be done with rusty planished iron (we suppose that you mean Russia iron) is to carefully scrape the rusty spots and polish the sheet with plumbago wet with a little sour beer or vinegar in the same manner as you would polish a stove. Any treatment with acid will take off all the planished surface.

(44) F. E. P. asks: What would be the probable result of the explosion of a cartridge sunk in clay or stiff soil 3½ feet below the surface—the probable depth and size at the top of the excavation? A. Dynamite acts in clay much in the same manner as in rock that is uniformly compact or not stratified. It blows out a pot shaped hole when well tamped. It is not economical in shallow holes, as it is apt to blow out a conical hole, taking out less material than in stone blasting. We have but little experience with clay blasting, but have heard that deep holes 5 or 6 feet are the most economical in effect. We would advise trying gun powder.

(45) Z. B. F.—Laps are not always thicker than other parts of belting, but they are stiffer, and together with the copper rivets cause quick running belts over small pulleys to produce uneven motion where the running parts are light, as spindles in cotton and silk machinery; but in wood and iron working machinery the difference is scarcely noticed.

(46) A. C. D. writes: We often see small statues, etc., in store windows that are bronzed, and the cavities of them filled with a green, blue, black, blackish red, etc. Can you tell me how this is done? Is it possible to lacquer over this work without spoiling it with the lacquer brush? A. In order to accomplish your desires, it will be necessary to purchase the so-called gold paint. It is best to buy it rather than attempt to make it. As generally sold in the market, the preparation consists of a solid metallic powder, which can be procured of some sixteen different tints or colors. It is mixed, according to the directions sold with the package, with the liquid preparation, and applied with a brush. The article coated or painted can on drying be finished by further application of a coat of furniture varnish.

(47) N. G. asks where the amianthus or asbestos is found in the United States. A. Asbestos is an exceedingly common mineral. It is mined in Rabun and Fulton Counties, Ga., in Northern Georgia, Western N. C. and S. C., Staten Island, Long Island, various localities in New York State, Maryland, Northern New Jersey, Pennsylvania, and Virginia. It is also found in Colorado and in California. There are several hundred localities from which it can be obtained.

(48) G. W. C., of Selma, Ala., writes, referring to former inquiry of B. J. B., that it is as safe there to cement cisterns right on the clay as any foundation which could be made, saying: "Our fire department here is supplied by cisterns entirely, the majority of them being cemented directly on to the clay sides, and in one case where there was no clay, nothing but sand, directly on to this. We have one cemented on to clay which is 100 feet long, 10 feet wide, by 9 feet deep, which has been in use for 6 years, and has not cost one cent for repairs except a new cover, which is of wood; it is good for as many more years. The sides of these cisterns are dug sloping, which always causes an outward pressure. These cisterns are not theoretical, on paper, but are in practical use daily with us." A. It is perfectly safe to cut cisterns in the indurated clays of the Tertiary in Alabama, even without cementing. These clays are nearly as hard as rock. We have seen cisterns from 30 to 40 feet deep, and as many in diameter, on the clay ridge west from Selma, where cistern water is their only choice.

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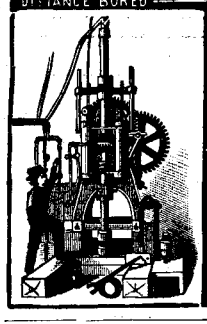

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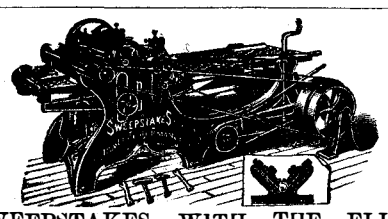

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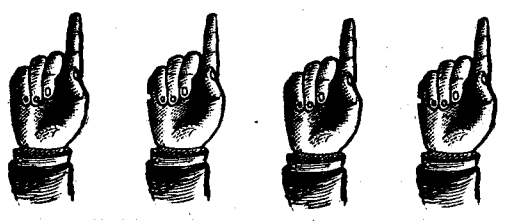

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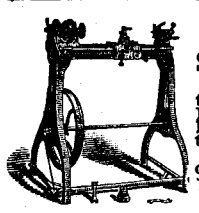

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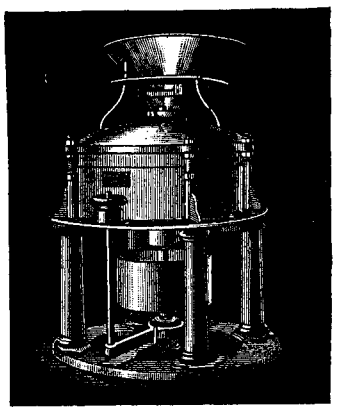

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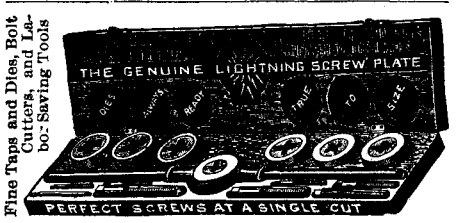

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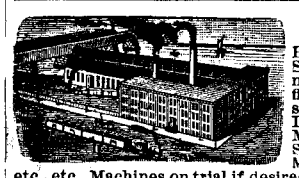

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to be worth anything must give pleasure to the one who receives it; nothing you can give a son, or a friend, will please him so much as a **good** Shot Gun or Rifle. We GUARANTEE all our goods, and **our prices are bottom.** Send your address on *postal card* for our large **10c.** catalogue, *full of fine engravings*, mailed **free.** Everything in the Gun line, Watches, Cutlery, etc. **J. A. Ross & Co.,** Successors to G. W. Turner & Ross. 16 and 17 Dock Square, Boston, Mass. ☞ *Please mention this paper.*

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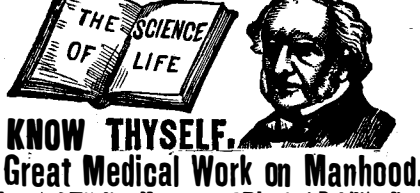

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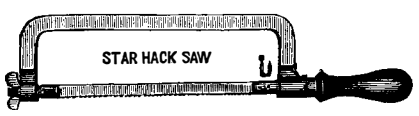

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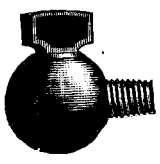

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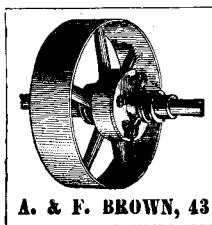

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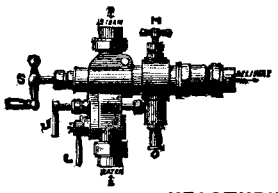

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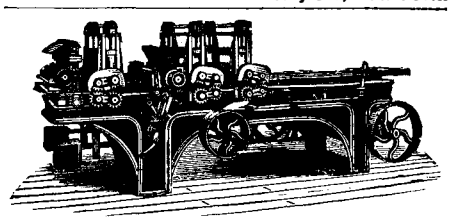

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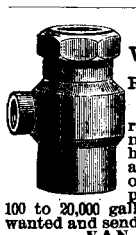

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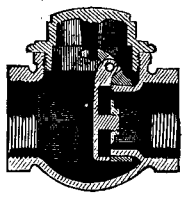

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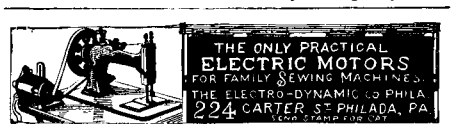

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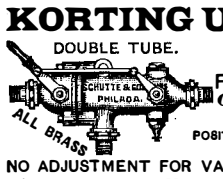

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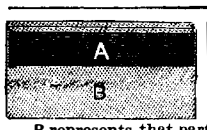

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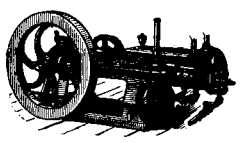

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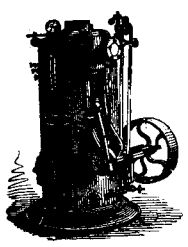

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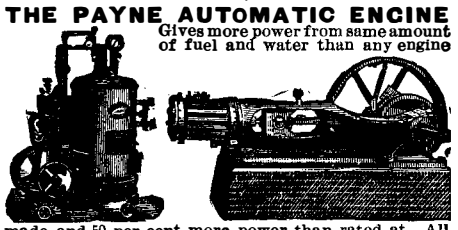

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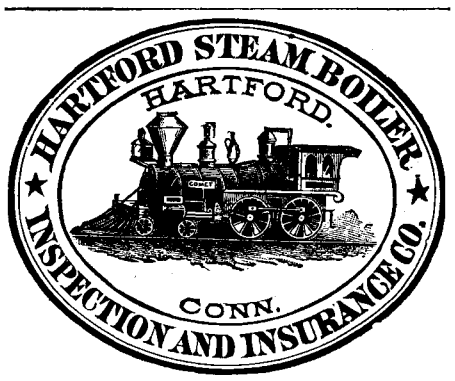

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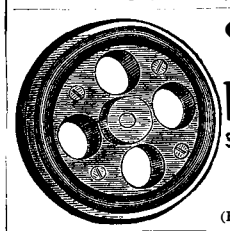

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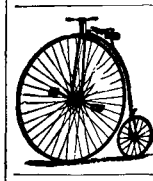

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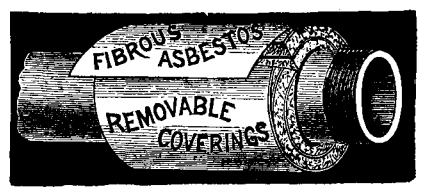

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